A SUMMARY OF THE NOVEMBER 1992, FINAL GUIDELINES FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED CONAWAPA PROJECT DRAFT FOR REVIEW AND COMMENT

1. Introduction

Manitoba Hydro (also referred to as the Proponent) has proposed the Conawapa Project, which includes the design, construction, operation, maintenance and decommissioning of the Conawapa generating station, expansion of the existing Henday Converter Station, new Bipole [illegible] transmission line, new Riel Converter Station, ground electrode, new Riel-D[illegible] transmission line, upgrading of the Southern Receiver System, new Henday-Riel and Riel-Ontario transmission lines and ancillary activities and facilities.

The federal and Manitoba Ministers of the Environment have jointly appointed an independent six-member Panel to conduct a public environmental assessment review of the proposed Conawapa Project. At the end of the review process, the Panel must recommend that the federal and provincial governments either approve, with or without terms or conditions, or reject the proposed Conawapa Project.

As part of this review, the Panel has held a series of public meetings and examined written submissions and other material. After deliberation, and taking into account the public input, the Panel is issuing Guidelines that direct the Proponent in its assessment of potential impacts of the proposed Conawapa Project upon the environment. This document is a summary of the Guidelines, a draft of which is being circulated for public comment. The term "environment" is intended to include the physical, biological, social, and economic setting that the proposed Project might affect.

Manitoba Hydro must prepare an Environmental Impact Statement (EIS) in accordance with the Panel's Guidelines. The EIS must identify valued environmental components that include components of the ecosystem and components and activities of the social, economic and cultural systems of communities affected by the proposed Project.

The Guidelines direct Manitoba Hydro to assess potential impacts of the proposed Conawapa Project, having due regard to past and future developments in northern Manitoba. Manitoba Hydro must determine, to the extent possible, the natural conditions prior to development, the changes to the environmental conditions to the present, and the capacity of the environment to cope with change.

In considering the boundaries for assessing the total environmental impacts of the proposed Project, the Proponent is required to consider not only the immediate locations of the physical components of the proposed Project, but also all areas where effects of the Project may be felt, such as where potentially affected species migrate. As well, the Proponent must consider the effects of the proposed Project now and in the future and whether the effects are temporary or permanent.

In preparing the EIS, the Proponent is required to consult and cooperate with people who may be affected by the proposed development and is encouraged to undertake joint study programs and meet regularly with other interested groups or agencies. Community consultations and the role played by community elders shall be described in detail. The Panel also recommends that the Proponent undertake a process of external peer review.

In the sections that follow, Manitoba Hydro is required to explain the need and justification for the proposed Conawapa Project. It must also describe in detail the Project, the environmental setting within which it is to exist, and the effects the Project may have on the environment. Finally, Manitoba Hydro must indicate how it plans to respond to those effects.

2. Project Need and Justification

The Panel will require a current understanding of the need and justification for the proposed Project. This information will play a necessary part in enabling the Panel to determine whether the effects of the proposed Project will be acceptable. The Proponent will be required to update the information which was provided to the Public Utilities Board in 1990, and to present it in a form suitable for the environmental assessment.

In this section of the Guidelines, the issues of demand load forecast and demand side management are raised. Requirements for the Proponent to explain the economic viability of the proposed Project are also included. The Proponent is required to discuss the effects of alternative development scenarios which might occur if the proposed Project is not approved. These may include non-hydro components such as demand side management, maintenance of thermal generating stations, installation of gas turbines, increased seasonal exchanges, use of cogeneration and use of solar, wind, and biomass energy.

The Proponent must also consider different sequences for future development which include a significant delay in development, and plans that incorporate future development without the sale of energy to Ontario.

The analysis of the alternative development scenarios identified in the Guidelines also requires the Proponent to consider factors such as: changes in discount rates, capital and operating costs, fuel costs for gas turbines, energy purchases and exchanges, load growth, success of demand side management and reductions in streamflow conditions.

3. Project Description

This section of the Guidelines requires the Proponent to describe in detail -- including plans, maps, time tables and cost estimates -- all aspects of the construction, operation, maintenance, and decommissioning of the proposed Conawapa Project. It must also describe how the proposed Project will function in the over-all Manitoba hydro-electric generating system.

Manitoba Hydro must provide information about the functioning of its existing hydro stations and water control structures, and the electrical power transmission and distribution system. It must conduct a systems operation analysis to determine if the upstream lake and reservoir levels and river discharges would be different with and without the Conawapa Project.

This section also requires that basic information be provided regarding the transportation, handling, storage, and disposal of dangerous goods and hazardous materials and the planned response to environmental accidents and emergencies. Measures to protect the health and safety of workers and the general public must also be described.

Information about the labour force requirements, construction camp siting and facilities, the removal of these facilities, and necessary clean-up must be provided by the Proponent.

The Proponent is also required to describe the general approach to the assessment of risks associated with the proposed Project. Some examples of risky events to be discussed include extreme weather conditions, forest fires, defective materials, and possible legal actions.

Manitoba Hydro must also describe plans for decommissioning of the proposed Project at the end of its useful life. Plans and estimated costs to decommission, restore and rehabilitate the sites of the proposed facilities are required.

4. Description of the Environmental Setting

This section instructs Manitoba Hydro to describe the environmental setting for the proposed Conawapa Project, and to establish baseline data against which the predictions of its environmental impacts will be measured. In the description, Manitoba Hydro must determine, to the extent possible, the natural conditions prior to northern hydro-electric development, and describe changes in the environmental system to the present. This is necessary to develop an understanding of how and why changes have occurred, to predict any cumulative impacts, and to assess the viability of potential remedial and mitigative measures.

Subject areas to be covered in describing the environmental setting include: climate; air quality; the land surface and geology; hydrology and water quality; aquatic, wetland, and upland plant life; animal life including invertebrates, fishes, amphibians, reptiles, mammals and birds; the mercury cycle; and the people. Information required on the people includes: community profiles; health; education and employment; land, water and resource use; and other socio-economic considerations such as sources of income and electricity rates.

Detailed information requirements have been identified by the Panel throughout this section of the Guidelines so that an understanding of environmental conditions before any northern hydro development and a clear picture of existing conditions are provided.

5. Environmental Impacts

This section instructs Manitoba Hydro to predict the environmental consequences of the proposed Conawapa Project. To do this, Manitoba Hydro must relate all elements of the Project (see Section 3) to the environmental setting (see Section 4), and determine where interactions may occur.

Manitoba Hydro must identify and assess impacts of each phase of the proposed Project including design, construction, operation, maintenance, and decommissioning. All direct and indirect effects of the proposed Project must be described and assessed. Manitoba Hydro must also make a qualitative comparison of the major environmental impacts of the alternative development scenarios.

Areas of potential impact to be described and assessed by the Proponent in this section include climate, air, land surfaces, hydrology and water quality, plant and animal life, and people. Some specific examples of impact areas to be described and assessed include the potential effects of the Project on:

- the production of greenhouse gases, air ions (e.g. ozone), and electromagnetic fields;

- shoreline erosion and the disturbance of land surfaces by borrow sites and rights-of-way;

- the daily and seasonal flow regime, ice regime and water quality, in the Nelson River and Nelson Estuary and in streams crossed by rights-of-way;

- important plant communities, particularly the consequences of impoundment and right-of-way clearing and maintenance on species composition and biological productivity;

- important or critical animal habitats, access by animal populations and people to those habitats, and the impacts of any changes in habitat quality or availability on the seasonal species composition and biological productivity of animal communities and on their harvest potential;

- mental health, disease, toxic substances or emissions (e.g. electromagnetic fields), and public and worker safety;

- training and education, employment, and contracting patterns with particular attention to opportunities for northern peoples;

- existing and planned land, water, and resource use including the effects of changes in the quantity, quality, or availability of the water and renewable resources;

- traditional cultural and spiritual activities such as fishing, trapping, hunting, the harvest of wild plants and traditional medicines, youth training, and the conduct of sacred ceremonies;

- the preservation of valued wilderness and recreational areas; and

- land ownership and land use rights.

Manitoba Hydro shall describe and assess the above predicted effects of development on the well-being and quality-of-life of affected peoples.

Particular attention shall be given to the proposed Project's impact on the upstream and downstream river regime including tributaries and the Nelson Estuary; Indian Lands and areas of Aboriginal interest; proposed and existing parks; rare, threatened or endangered species and unique species concentrations; and human health.

Manitoba Hydro shall conduct a systematic analysis of the effects of all potentially toxic materials (e.g. herbicides or methyl mercury), or their precursors which may be spilled, released, created, mobilized or transported as a consequence of the proposed development.

This section of the Guidelines also considers cumulative impacts, such as those environmental disturbances which occur too frequently in time or space for the environment to recover. Such disturbances may add to one another to create progressively greater effects, or interact with one another to create an effect greater than the sum of the parts. Manitoba Hydro must consider the environmental impacts of the proposed Project as they relate to one another and to those of other existing and future projects. This examination will consider the different impacts described for the various components of the proposed Project and the interaction of these components. The effects of the proposed Project adding to or interacting with other developments must also be studied.

The Guidelines require that the Proponent consider the potential contributions of a variety of other existing and planned developments (currently under review) to the cumulative effects of the proposed Project. Some examples of other activities to be considered by the Proponent in addressing the issues surrounding cumulative impacts, include other components of the Churchill-Nelson system and Lake Winnipeg Regulation, the La Grande complex and proposed Grand Baleine project which also may affect Hudson Bay, and the proposed North Central Transmission Line project.

Existing and planned resource developments, including activities such as timber harvesting and mineral extraction, must also be considered in this assessment of cumulative environmental impacts.

The effects of extreme weather on the proposed Project, and its ability to withstand the effects of natural geological and hydrological processes must also be described and assessed by Manitoba Hydro.

Information is also required about Aboriginal and Treaty rights that are protected by Canadian law and may be affected. The Proponent is asked how it will ensure that it has the legal right to cause any such effects.

6. Response to Environmental Impacts

In this section of the Guidelines the Proponent is required to describe how it plans to respond to any potentially adverse environmental impacts from the proposed Conawapa Project. Measures to address these impacts include mitigation, and compensation for residual impacts.

Mitigation is interpreted broadly to include measures taken to eliminate, reduce or control any adverse environmental impacts and also includes any measures taken to enhance or prolong potential benefits arising from the proposed Project. Residual impacts are the adverse environmental effects which remain after mitigative measures have been applied. Compensation provides a remedy, either in money or in kind, for the residual impacts of the proposed Project.

Monitoring and research programs must be developed by Manitoba Hydro to test the accuracy and validity of its predicted environmental impacts, to identify unpredicted effects, and to test on an ongoing basis the effectiveness of mitigation and compensation. The Proponent shall indicate how it will respond, in terms of mitigation and compensation, to results of the monitoring and research programs.

This section of the Guidelines also requires that the issue of compliance be addressed by the Proponent to ensure that mitigative and compensative measures are fully implemented.

7. Report Format

In this section of the Guidelines the Proponent is provided with instructions for the preparation of the Environmental Impact Statement in terms of format and layout of the document. Also included are requirements for preparation and translation of the summary information.

8. References

This section of the Guidelines identifies the source of a number of publications mentioned.

Appendix A. Environmental Impact Assessment Review Process and Panel Terms of Reference

This appendix to the Guidelines summarizes the environmental review process and includes a copy of the Canada-Manitoba Agreement on Terms of Reference for a Federal-Provincial Panel to Conduct a Public Environmental Assessment Review of the Proposed Conawapa Project.

Appendix B. Definition of Terms

In this appendix to the Guidelines, definitions of terms which are important for understanding the Guidelines are provided.

Appendix C. Ethical Principles for the conduct of research in the north

A copy of this article from the Association of Canadian Universities for Northern Studies (1982) is provided in this appendix to the Guidelines.

Appendix D. Conawapa Project Location Map

Map showing location of primary components of the proposed project has been provided by Manitoba Hydro.

This summary has been prepared for public information purposes. Copies of the draft Guidelines are available from the Joint Review Secretariat at 715-330 Graham Ave., Winnipeg, MB R3C 4A5, Tel: (204) 945-8425, Toll Free in Manitoba: 1-800-282-8069, Fax: (204) 945-0175.

CONAWAPA
ENVIRONMENTAL
REVIEW PANEL

FINAL GUIDELINES
FOR THE PREPARATION OF
AN ENVIRONMENTAL IMPACT STATEMENT
ON THE
PROPOSED CONAWAPA PROJECT

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DRAFT
FOR COMMENT AND REVIEW

NOVEMBER 1992

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1. INTRODUCTION

1.1 Background

A. Manitoba Hydro has proposed plans for a new hydroelectric generating station on the lower Nelson River, a transmission line complex to carry electricity from the station to southern Manitoba, and another transmission line to link Manitoba with Ontario. This proposal is known as the ***Conawapa Project***, and its component parts as the ***Conawapa Generating Station***, ***Bipole III Transmission Line Complex***, and ***Manitoba-Ontario Interconnection***.

B. Under the Manitoba Environment Act and the federal ***Environmental Assessment and Review Process (EARP) Guidelines Order***, the Conawapa Project is subject to public environmental assessment review.

C. An independent and impartial Joint Federal-Provincial ***Panel*** has been appointed to conduct the public review process. Its main tasks are:

1) to prepare Guidelines for the preparation of an ***Environmental Impact Statement*** (EIS) by Manitoba Hydro;
2) to conduct a public Environmental Impact Assessment review; and
3) to advise Manitoba and Canada on whether the ***Project*** should be allowed to proceed and, if so, under what terms and conditions. The review process is explained more fully in Appendix A.

1.2 Purpose

A. This document presents Guidelines for the format and content of the Environmental Impact Statement to be prepared by Manitoba Hydro. These Guidelines have been prepared by the Panel after public consultations with the general public and government representatives. The purpose of the Guidelines is to ensure that the ***environmental impact*** of the proposed Conawapa Project is determined and properly considered.

B. Throughout these Guidelines, terms such as "environmental", ***"ecosystem"***, ***"expert"***, "impact", and ***"Aboriginal"*** should be interpreted in their broadest sense. For example, the ***environment*** shall be understood here in its generic sense to encompass the physical, chemical, biological, economic and social environments; ***impacts*** refer to the likely nature and extent of any consequences, whether positive or negative, incremental or cumulative, of a proposed action; and Aboriginal, for the purposes of this document, includes Treaty and non-Treaty Indians, Metis, and Inuit. Definitions of these and other terms that are important for understanding the Guidelines are provided in Appendix B. Each term listed in Appendix B is marked by boldface italicized type the first time it appears in the text of the Guidelines.

C. The intent of the Environmental Impact Statement is to:

1) explain the need for, and justification of, the proposed Conawapa Project;
2) describe the Project and the environment within which it is proposed to exist;

3) describe a plan for the decommissioning, restoration and rehabilitation of the Conawapa Project;
4) identify potential impacts of the Project;
5) describe measures to eliminate, mitigate or compensate for any adverse impacts; and
6) propose mechanisms for research, ***monitoring***, and compliance if the Project is approved.

D. In preparing these Guidelines, the Panel has been guided by its Terms of Reference (Appendix A). The Panel has interpreted its Terms of Reference and prepared these Guidelines taking into account: public input from Community Meetings, Scoping Workshops, and correspondence; draft guidelines prepared by the Technical Advisory Committee consisting of representatives of the governments of Canada and Manitoba; the information, report and recommendations of the Public Utilities Board (1990) in respect of Major Capital Projects of Manitoba Hydro; federal and Manitoba legislation and relevant legal decisions; and the theory and practice of ***environmental impact assessment***. The information sought by the Panel in these Guidelines is intended to assist the Panel and the public in understanding the Conawapa Project and its potential positive and negative impacts.

1.3 Methodological considerations

A. A number of basic issues will affect assessment methodology, so the purpose of this subsection is to provide direction to Manitoba Hydro on some of these issues. The subsection addresses the questions of whether the effects of past and future developments must be considered, what constitutes the ***baseline***, how far the assessment must extend in time and space, and other matters. **These considerations underpin the whole assessment and must be reflected in each section of the resulting Environmental Impact Statement.**

1.3.1 Context

A. The task facing Manitoba Hydro in its preparation of the EIS is very complex. It will require an assessment of the potential impacts of the Conawapa Project in the context of both past and future developments. This "cumulative impact assessment" is necessary because the Project cannot be developed in isolation from other developments and the impacts it creates will not operate in isolation from the impacts of those other developments. Indeed, the Project is simply the latest in a series of developments, hydroelectric and otherwise, which may affect environmental conditions in and around the Nelson River drainage basin and in the vicinity of the ***power*** transmission lines.

B. The primary reason for considering the effects of past and future developments is that the effects of an incremental change are not always in proportion to the magnitude of the change. Of particular concern are those effects which add to or interact with one another. For example, a seemingly small incremental change may have a catastrophic effect if it is one of a series of similar changes that occur too close together in time or space for a system to recover. Bioaccumulation of toxic substances is one such process. The combined effects of two different changes may also be greater than the sum of

their parts, like high winds and low temperatures which may be uncomfortable when they are experienced alone but together create a dangerous windchill.

C. In order to assess the potential impacts of the Conawapa Project, the EIS must determine, to the extent possible, the natural conditions prior to northern hydroelectric development (the baseline), the evolution of the environmental conditions to the present, and the capability of the environment to cope with change. An understanding of why and how changes have occurred will be necessary to predict future environmental conditions with and without Conawapa, and to assess the viability of potential remedial and mitigative measures. Where the present conditions are significantly different from their natural state, or are in a state of constant change (flux) as a result of past developments, they are unlikely to provide a sound basis for predicting the effects of further change.

D. Manitoba Hydro shall assess the effects of existing developments to the extent that they are definable and useful to describe the existing environmental situation and for predicting potential ***cumulative impacts*** of the Project. The effects of the Churchill-Nelson Diversion and of Lake Winnipeg Regulation must be given particular attention in this regard.

E. The traditional knowledge of ***elders*** in communities affected by past developments will be important for understanding and responding appropriately to identified changes in the environment.

1.3.2 Focus

A. As proposed, the Conawapa Project would extend over a vast area and could have many effects over a long period of time. Physically, the Project could extend from the lower Nelson River to Winnipeg via ***corridors*** east or west of Lake Winnipeg, and from Winnipeg to the Ontario/Manitoba border via corridors crossing southeastern Manitoba. It is not possible to catalogue all of the potential ***environmental effects*** for a project of this scale. Consequently, Manitoba Hydro must identify a set of ***valued environmental components*** to provide a focus for subsequent studies.

B. These valued environmental components must include not only the "valued ecosystem components" described by Beanlands and Duinker (1983), but also valued components or functions of the social, economic, and cultural systems that contribute most to the social well-being and quality-of-life of area residents (Little and Krannich, 1988).

C. To ascertain the values attached by people of different backgrounds and cultures to various environmental components, Manitoba Hydro must consult all potentially affected groups and employ such other methodologies as are useful. An extensive program of community consultations must be undertaken, particularly in remote areas that may be affected by the development. Federal, Provincial, regional, municipal and Aboriginal governments; the academic community; and a representative sample of individuals in the ***Study Area***, including elders, must also be consulted.

D. If different groups assign different values to certain components, then Manitoba Hydro must explain and justify the values that it retains, or present a series of analyses based upon the different values that it identifies.

E. Care must be taken to ensure that all environmental components are properly considered, not just those that have direct socio-economic value.

F. The EIS must contain a checklist showing those environmental components that are:

1) expected to be impacted and sufficiently valued to be studied;
2) expected to be impacted but not sufficiently valued to be studied; and
3) not expected to be impacted. A corresponding rationale for the designation of each environmental component is required.

1.3.3 Boundaries

A. The primary boundaries for assessing the full breadth of the environmental impacts of the Project must be ecological, since natural systems seldom respect administrative or project boundaries. These ecological boundaries must reflect, among other things, transport mechanisms and migrations and the response and recovery times of affected systems. Spatially, this will mean considering factors such as: how far a contaminant might be transported by the wind or water; how far a potentially affected species migrates; and how far people travel to hunt, trap, or fish. Temporally, it will mean considering factors such as whether the effects would be immediate or would occur slowly over several generations, and whether they would be temporary or permanent.

B. Manitoba Hydro must show clear temporal and spatial boundaries for the analysis of expected changes in each valued environmental component. These boundaries must be explained and justified, bearing in mind that they may not be the same for each element of the Project or for each valued environmental component. The temporal boundaries for the analysis shall extend from before northern hydroelectric development was begun in Manitoba as far forward in time as impacts from the Project may reasonably be expected to occur. The spatial boundaries for the analysis shall extend as far above and below the surface of the land and water (vertically) and as far geographically (horizontally) as impacts from the Project may reasonably be expected to occur.

C. Maps showing the geographical area for the study of each valued environmental component shall be prepared. Manitoba Hydro shall define its study area based upon an analysis of the interrelationships of those geographical areas, ensuring proper consideration of each valued environmental component with respect to the Project components. Coverage must be sufficiently broad to enable readers to understand systems operation; including Lake Winnipeg Regulation and the Churchill-Nelson Diversion, the environmental setting for the proposed generating station and transmission line complexes, and the potential for cumulative impacts. It should also reflect the principles of ***bioregionalism***.

D. In the initial sections of the EIS, which describe the Project and its setting, Manitoba Hydro must clearly describe constraints to its investigations posed by:

1) the political, social, and economic realities (administrative boundaries);
2) the time and space scales over which natural systems operate (ecological boundaries); and
3) the limiting state-of-the-art in estimating or measuring past and future ecological changes (technical boundaries).

E. Manitoba Hydro shall justify its choice of study boundaries, indicate whether they are fixed or subject to the discretion of the investigators, and describe how it plans to respond to constraints posed by boundaries, particularly in terms of its response to environmental impacts. The ***Proponent*** (Manitoba Hydro) shall also describe the level of detail at which various environmental components are studied.

1.3.4 Criteria for judgement

A. Criteria for judgement by Manitoba Hydro of the significance of environmental changes over time and space, and the assumptions underlying those criteria must be explicitly and unambiguously defined.

B. These criteria shall reflect the ecological, socio-economic, and statistical interpretations of the concept of significance. They shall include considerations of the extent to which important features of the environment may be affected, their potential for recovery, and the estimated time required for recovery if recovery is possible. They must also reflect a wide range of perspectives on the values attached by people of different backgrounds and cultures to various environmental components.

C. Terms used to describe judgements (e.g. significant, minor, long-term, regional, adequate, appropriate) shall be clearly defined, and the justifications and reasoning underlying individual judgements clearly explained. If this is not possible in any particular case, then reasons must be given. Explicit attention must be given in any judgements to uncertainties arising from lack of information, and to the degree of confidence in any predictions and the grounds for this confidence or lack thereof. Sufficient information and analysis must be provided to enable readers to understand and confirm the conclusions.

1.3.5 Consultation and co-operation

A. Manitoba Hydro shall consult and cooperate with people who may be affected by the proposed development, and is encouraged to undertake joint study programs with other groups or agencies. In particular, there shall be extensive public consultations with potentially affected Aboriginal peoples on environmental conditions, past and present, and on the potential Project impacts and responses to those impacts (see Appendix C). Each section of the Environmental Impact Statement shall clearly identify and describe in detail the specific linkages between public input and the contents of that section.

B. Traditional knowledge will be important in this impact assessment and in later monitoring and research. Traditional knowledge must be used fully, both to provide information that is not available from other sources and to complement and improve existing information. Cross-cultural research methodology must be appropriate both to the culture and to the problem, and

shall be described in detail. Elders shall be consulted as part of the impact assessment process.

C. The Panel recommends that Manitoba Hydro undertake a process of external peer review. Where possible, this should begin with study planning and carry through to review of the final product. In some instances this review might best be accomplished by consulting expert individuals, whereas in other areas such as the consideration of alternative development scenarios or of cumulative impacts, it might best be accomplished by a technical committee consisting of representatives from the utility and ***participant*** groups and independent experts.

D. The Panel also recommends that technical specialists of Manitoba Hydro and participant groups meet periodically. The purpose of these meetings would be to avoid unnecessary duplication of efforts and to facilitate the timely exchange of data and information. Manitoba Hydro should make information relevant to the review available to other participants at the earliest practical time. Wherever possible, the databases should be compatible with those of the appropriate government agencies (e.g. Manitoba Natural Resources' Fisheries Inventory and Habitat Classification System). Measures to facilitate public access to the databases, and the future availability and comparability of the databases shall be described.

1.3.6 Other considerations

A. The Environmental Impact Statement shall incorporate and reflect the principles of ***sustainable development*** as contained in "Towards a Sustainable Development Strategy for Manitobans" (Government of Manitoba, 1990), Canada's Green Plan (Government of Canada, 1990), and the developing policies under the Land and Water Strategy published by the Government of Manitoba.

B. The EIS should also recognize the complexity of the Conawapa Project and the nature of the staged review process. It must contain sufficient detail to ensure that the Panel can fully carry out its mandate and must be methodologically rigorous.

C. In addressing the requirements of these Guidelines and other issues that may emerge from its own research and reflection, Manitoba Hydro must describe past, present, and future environmental conditions to the extent necessary to predict the effects of changes that may occur in the environment.

D. Manitoba Hydro shall describe its plan for investigating the interactions between the Conawapa Project and the environment, and demonstrate how that plan was used to coordinate the individual studies undertaken.

E. The plan for investigation must respect and reflect differences in values related to culture, age, and sex. It should also take into account the past, present, and future dynamism of the ecosystem, including that of the relevant cultures, societies, and economies.

F. The benefits and disadvantages of the Project may be concentrated in different areas or socio-economic groups, and many impacts may not lend

themselves to quantification. Manitoba Hydro must deal explicitly with these problems in developing methodologies, collecting and analyzing data, and proposing remedial measures and monitoring programs.

G. Methods used to collect and analyze all data must be rigorous, state-of-the-art and clearly and fully described together with any underlying assumptions. Original field or laboratory research shall be undertaken wherever it is necessary and reasonable to verify or complete existing data, or to collect essential data that are not already available. The reliability of the data must be critically analyzed and any limits with respect to accuracy or interpretation must be identified.

H. Names used to describe species or locations shall be unambiguous. Species must be identified by both their common and scientific names, and geographical locations by their gazetted and local names. Wherever possible, to facilitate the work of the Panel and the review participants, maps and other graphical representations should be of common scales to allow for comparison and overlay of mapped features. Maps of the 1:1,000,000 scale are recommended for Project overviews, maps of the 1:250,000 scale for land use and resource inventories, and maps of the 1:2,000 scale for information related to fisheries habitat downstream from Limestone.

I. Forecasts and impact predictions must be stated explicitly in the EIS, together with the basis on which they are made. These predictions must include the nature, magnitude, duration, extent, level of confidence, and range of uncertainty of the predicted changes. Manitoba Hydro shall also review current theory and practice of cumulative impact assessment and justify the methodology used to predict cumulative impacts.

J. Plans to monitor and research the possible effects of the Project must be described, including their scope, timing, and relationships with existing monitoring and research programs. Manitoba Hydro shall clearly present its proposals for mitigating predicted adverse changes, their anticipated effectiveness, and ***residual impacts***. Manitoba Hydro's commitment to implement recommendations on mitigative measures, and to compensate for undesirable residual impacts must be clearly and explicitly stated.

K. Plans to decommission the generating station and its ancillary facilities, including the proposed transmission lines, and to rehabilitate disturbed areas following decommissioning shall also be described. Potential environmental impacts of decommissioning, restoration, and rehabilitation must be clearly stated together with any remedial or mitigative measures which might be taken before or after decommissioning.

L. The research methods, interpretation of results, conclusions, and recommendations shall be supported by a thorough review of appropriate international literature. All sources of information, published and unpublished, traditional or scientific, shall be referenced in an approved scientific format. The names and relevant experience of those collecting and interpreting data shall be presented for each subsection of the EIS. Manitoba Hydro will ensure the availability of all literature consulted.

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The sections that follow are intended to serve as an outline for the Environmental Impact Statement, as well as guidelines for its preparation. Further direction on the format of the EIS is found in Section 7.

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2.0 PROJECT NEED AND JUSTIFICATION

2.1 Introduction

A. The issue of the need for the Project was addressed by the Public Utilities Board (1990), "Review of Manitoba Hydro's Twenty-Five Year Capital Development Plan" (P.U.B. Review). This Panel's Terms of Reference direct the Panel to "have due regard for the information, report and recommendations" of the P.U.B., referred to here as "P.U.B. materials".

B. This provision does not ask the Conawapa Environmental Review Panel to reconsider questions that were considered by the PUB. The role of the Panel is to conduct an environmental assessment review of the proposed development. An understanding of the need and justification for the proposed development should provide a basis for the Panel to make judgements about the acceptability of the environmental effects of the Project.

C. To obtain full benefit from the P.U.B. materials, the Panel will require an appreciation of how conditions may have changed since 1990 and how the materials may be applied to the environmental assessment review.

D. Significant changes in the economic situation in Manitoba and Ontario have occurred during the past two years, and Manitoba Hydro's forecast of need for new ***energy*** sources has also changed.

E. In order to provide a current understanding of the need and justification for the proposed Conawapa Project, Manitoba Hydro must explain:

1) the need for the power to be supplied by the Project; and
2) why this need might best be met by the proposed Conawapa Project.

F. Wherever practical and appropriate, this understanding should draw upon the P.U.B. materials. Changes required to bring the P.U.B. materials up to date and to make them applicable to the Conawapa environmental review should be integrated in such manner as will avoid ambiguity or confusion and will facilitate a comprehensive and current understanding.

G. In this section, the issues of demand load forecast and ***demand side management*** shall be considered with a view to better understanding the issue of Manitoba energy needs in the foreseeable future and the scope for energy conservation measures as an alternative to capacity expansion. The proposed Conawapa Project shall be examined in depth in terms of its economic viability. Finally, appropriate alternatives shall be examined. These issues are all interrelated, and seek collectively to provide a current understanding of the need and justification for the proposed Conawapa Project.

H. Manitoba Hydro shall present in the following sections:

2.2.1 an analysis of the ***load forecasting*** process and a discussion of power export;

2.2.2 an examination of how consumer demand for electricity may be reduced, as well as shifted from peak to off-peak times, a process known as demand side management (DSM);

2.3.1 an updated presentation of the proposed Conawapa Project, including its most significant economic parameters;

2.3.2 an evaluation of how these parameters may change under changing future circumstances, a process known as ***sensitivity analysis***;

2.4.1 a presentation of non-hydroelectric components that could be included in an alternative development scenario;

2.4.2 an examination of alternative development scenarios; and

2.4.3 an evaluation of how the comparison between the proposed development scenario and alternative development scenarios may change under changing future circumstances; and

2.5 a discussion of financing for the proposed development scenario and alternative development scenarios.

I. When presenting the information and conducting the studies that will be discussed below, the Proponent shall show both the financial costs and the ***environmental costs***. Where the latter cannot be quantified, they shall be described qualitatively. Comparative evaluation shall include the nature, the number and the duration of jobs that will be created and the location(s) where these jobs will occur. Alternatives shall also be evaluated with respect to their relative impacts on the conservation of biological diversity, the preservation of rare and endangered species, their contributions to social and economic equity, and the financial risks borne by all those affected by the proposed Project.

2.2 Demand forecast

2.2.1 Manitoba load forecasting

A. Manitoba Hydro shall provide its current load forecast to the year 2028 together with any underlying assumptions.

B. Manitoba Hydro shall describe how the predicted values of a number of identified variables, together with changes in those predicted values, affect the load forecast of Manitoba electricity consumption. Specifically, the Proponent shall describe quantitatively the sensitivity of the short-term, medium-term and long-term Manitoba load forecasts to alternative predictions about the following variables:

1) the real gross domestic product (GDP) of the Manitoba economy;
2) the population of the province of Manitoba;
3) the age distribution of the population of Manitoba;
4) the price of electricity for various classes of consumers;
5) the annual cost of substitute fuels such as natural gas and oil;
6) the cost of converting from one means of heating to another; and
7) other key variables identified by the Proponent.

C. Manitoba Hydro shall describe the underlying reasoning, assumptions and rationale for the forecasts made with respect to all identified variables. The

Proponent shall provide an indication of the confidence which it attaches to the forecast values.

D. In Manitoba Hydro's "Economic Outlook, 1992-2012", Spring 1992, the proponent provides "a set of integrated economic parameters ...used for long term planning purposes." The Proponent shall state all of the assumptions that underpin its predictions about the future values of those economic parameters. Where such assumptions and economic forecasts differ significantly from those offered by other public institutions such as the National Energy Board and the Bank of Canada, the Proponent shall provide evidence in support of its own chosen assumptions.

E. The Proponent shall describe, in a simple and non-technical manner, the over-all process for combining and integrating its forecasts of relevant variables into a consistent overall forecast of the Manitoba load.

F. Manitoba Hydro shall compare in detail its load forecasting model with that of the National Energy Board, as contained in National Energy Board, "Canadian Energy Supply and Demand 1990-2020", June 1991, and explain why its model forecasts a different ***load demand***.

G. The Proponent shall determine the dates by which Manitoba needs new electrical energy sources under four different load demand forecasts for Manitoba, namely:

1) Manitoba Hydro's medium-high load demand forecast for Manitoba;
2) Manitoba Hydro's base load demand forecast for Manitoba;
3) Manitoba Hydro's medium-low load demand forecast for Manitoba; and
4) the National Energy Board's June 1991 forecast of Manitoba load demand.

H. In each of these four cases, the Proponent shall assume the following:

1) the Conawapa Project is not carried out;
2) the concomitant sale of power to Ontario is cancelled;
3) the current Northern States Power contract is not renewed when it expires;
4) Manitoba Hydro's demand side management (DSM) forecast;
5) diversity exchange is continued; and
6) operation of thermal plants is continued.

I. The Proponent shall describe the policy and practice of the sale of surplus energy, including the essentials of all export commitments that are in force at the present time, those that are under negotiation, and any potential commitments that are under consideration at the present time.

2.2.2 Demand side management

A. Demand side management (DSM) is the policy of lowering the demand for electricity by promoting energy efficiency, and of inducing a shift in the pattern of demand from peak to off-peak times. Manitoba Hydro shall describe the considerations that underpin its DSM policy and program. In particular, what are the objectives of the program? What role is played by environmental considerations in DSM policy and program formulation and evaluation? What

weight is given to the objective of postponing or avoiding the need for additional hydroelectric development in formulating DSM policy?

B. Some participants have noted that DSM has become an increasingly accepted alternative to the expansion of system ***capacity*** as a response to the growth in power requirements. Manitoba Hydro shall discuss in detail the opportunities that exist in Manitoba to substitute DSM for system capacity enlargement. The benefits and costs expected from pursuing this policy shall be described.

C. Participants have suggested that Manitoba Hydro can induce energy conservation by creating the appropriate market incentives. Three types of market incentive have been identified:

1) subsidizing energy-conserving devices (e.g. outdoor timers) through rebates to stimulate more widespread market acceptance and use;
2) uniformly raising electricity prices to induce lower levels of electricity consumption; and
3) introducing an inverted block pricing structure for electricity, setting the price for the first block of electricity at the lowest level and pricing successive blocks of electricity at progressively higher rates.

D. The Proponent shall describe and assess the relative effectiveness of these three approaches in achieving energy conservation in Manitoba.

E. Participants have also suggested several measures for inducing consumers to alter their daily pattern of electricity consumption away from peak-time use. These measures constitute tools for load management. Two types of market incentive were identified for implementing this objective:

1) peak-load pricing, involving relatively higher prices during peak-time use; and
2) offering consumers the option of being supplied with interruptible power during peak hours, in exchange for reduction in electricity prices.

F. Manitoba Hydro shall describe and assess the relative effectiveness of these two load management measures for a range of electricity prices.

G. The Proponent shall describe and assess the effectiveness of its current allocation of expenditures to its "PowerSmart" program, comparing its allocation on a per capita basis, the distribution of its allocation, and the performance of its program with those of other hydroelectric utilities such as British Columbia Hydro, Ontario Hydro, Bonneville Power Authority, and Pacific Gas and Electric in California.

H. Manitoba Hydro shall investigate the effectiveness of the following specific DSM measures:

1) a program to insulate, in a state-of-the-art manner, all electrically heated homes in Manitoba;
2) a program to subsidize and promote the conversion from hydro-electric power to alternative energy sources; and
3) a program to foster co-generation of electricity.

I. The Proponent shall describe the factors that account for any revised predictions about the effectiveness of its DSM program since the PUB Review.

J. Manitoba Hydro shall indicate the ***technical potential*** estimates for energy conservation by all Canadian electrical utilities for the year 2000.

K. Manitoba Hydro shall provide estimates of the elasticity of present and future demand for electricity. It shall include an assessment of the responsiveness of Manitoba load demand to a range of electricity price variation. Any ongoing research in estimating market demand curves for electricity and the methodology of that research shall also be described.

2.3 Proposed Conawapa Project

2.3.1. Proposed development scenario

A. This section must show the most up-to-date load forecast of the Manitoba Hydro System, including domestic loads as well as Export Agreements for the years 1993-2028. All changes, from year to year, shall be explained in detail. The information shall be shown in tables as well as in easy-to-understand graphs.

B. There shall be a presentation of the system capacity as it exists, and as it is visualized to develop in the proposed development scenario, over the period 1993-2028. All changes shall be explained in detail. There shall be a clear explanation of how ***reserve capacity*** and ***system losses*** have to be treated in order to compare total installed capacity with load demand.

C. Manitoba Hydro shall present its calculations of the financial aspects of the Project in a clearly understandable manner, including the following items 1) through 4):

1) A table extending over the years 1993 - 2028, year by year, showing:
   a) the expected capital expenditures associated with the Conawapa Project;
   b) the annual expenditures for operation and maintenance;
   c) the annual capacity and energy production;
   d) the calculated revenues from ***capacity charges*** from the ***Ontario sale***;
   e) the calculated revenues from ***energy charges*** from the Ontario sale;
   f) the estimated value of the remaining capacity and energy to the Manitoba system;
   g) the estimated revenues from the sale of any ***surplus capacity*** and energy of Conawapa to clients outside of Manitoba; and
   h) the total revenues.

   The revenues and costs shown in the above table shall be given in both inflated prices and in 1992 prices. For the sake of simplicity in making the above calculations, the same inflation rate shall be used for both the construction price index and the consumer price index. This table shall be supplemented with a set of explanatory notes and a numerical example for the year 2010, showing how the formula of the Ontario Agreement translates into dollar values, and how items d) and e) are determined.

2) An approximation of the annual cost and income streams for the years 2028-2055 associated with Conawapa, duly explained.

3) A calculation of the financial ***real rate of return*** on the investment required to construct the Conawapa Project, based on the above figures. This calculation shall be based on constant 1992 prices of revenues and costs.

4) A calculation of the ***present value*** of the net financial benefits to Manitoba Hydro, discounted to 1992, of the entire Project using a ***discount rate*** equal to the long term yield of Manitoba Hydro Bonds. This calculation to be based on inflated revenues and costs.

2.3.2 Sensitivity analysis

A. The Proponent shall conduct a sensitivity analysis of the Project with the same format and accounts as described in the previous section. This analysis shall evaluate the following changes in major variables:

1) a construction cost increase and cost decrease of 20%, not due to inflation or deflation;
2) construction requiring one, two or three years longer than planned;
3) changes in Manitoba load growth, assuming Manitoba Hydro's medium-high and medium-low forecasts (Manitoba Hydro System Load Forecast, 1991), as well as the National Energy Board 1991 growth rate estimate resulting in 4045 MW demand in the year 2010, and continuing at the same rate thereafter;
4) reduction in streamflow as a result of the Provinces of Alberta and Saskatchewan making full use of their ***streamflow entitlement*** on the Saskatchewan River as well as on the Churchill River; and
5) a reduction in long term average streamflow conditions on the Nelson River and the Churchill River of 20 percent as a result of possible climatic change.

B. In calculating the 1992 value of the net financial benefits to Manitoba Hydro for the case under subsection 2.3.1 C. 4) above, the Proponent shall also use discount rates that are 2% higher and 2% lower.

C. The Proponent shall assess the mathematical probability or range of probability that is associated with each of the above changes in major variables from 1) to 5), inclusive.

2.4 Alternative development scenarios

A. The consideration of environmental effects of alternative development scenarios has long formed part of competent environmental assessment. Such consideration may provide a more appropriate point of reference than the so-called "null alternative", i.e. simply doing nothing. In addition, the Panel's Terms of Reference require it to consider the alternative of not proceeding with the proposed development. Given the provisions of The Manitoba Hydro Act, Manitoba Hydro may not have the option of simply doing nothing if the Conawapa Project is not approved.

B. The Panel therefore requires that the EIS provide an understanding of environmental consequences of alternative courses of action that may be adopted if the Project is not approved. Consideration should be given to each scenario that might be considered potentially practical. Scenarios should be defined in sufficient detail to permit independent analysis, and their selection should be justified as representative and unbiased. Environmental effects of each scenario should be described comprehensively so as to permit broad comparisons to be made, but not at the same level of detail as is required for effects of the proposed development.

C. In formulating alternative scenarios, Manitoba Hydro shall consider the following components listed below.

2.4.1. Non-hydroelectric alternative scenario components

A. Manitoba Hydro shall review and present all pertinent information (***capital cost***, cost of operation and maintenance, fuel cost, length of useful life, performance aspects, reliability, risk and environmental impact) of all non-hydroelectric components that may be considered in an alternative development scenario. This review shall include, but not be limited to, the following components:

1) an aggressive demand side management program, comparable to what is now being planned in Ontario and in British Columbia. Some discussion of this topic is contained in Section 2.2.2. The Proponent shall estimate the costs that Manitoba Hydro would have to incur in subsidizing the use of more efficient equipment and appliances by end users and discuss options for financing and recovering these costs;
2) keeping the Brandon and Selkirk ***thermal generating stations*** in service;
3) the installation of ***gas turbines*** to function normally as spare capacity and in the peak of the load. During low flow conditions these units can firm up installed hydro capacity and energy;
4) increasing short term purchases from, and seasonal exchanges with, other utilities. Manitoba Hydro currently purchases power on a short-term basis from its neighbor utilities in dry years, and also has summer-winter exchange contracts in place with other utilities. These arrangements allow these utilities to serve each other's ***peak demands***, which are high in winter in Manitoba and high in summer in the U.S.;
5) the use of cogeneration which is the simultaneous production of steam and electricity in a manner which is more efficient than producing the two products separately. The Proponent shall determine the total economic potential of cogeneration in Manitoba and what measures and policies would be necessary to encourage the development of this potential; and
6) the use of ***solar energy***, ***wind energy*** and ***biomass energy***. The Proponent shall determine the feasibility and cost of solar, wind and biomass energy generation in Manitoba, and shall discuss the practicality of using these alternative power sources in Manitoba with the currently available technology and with the expected future improvements in technology.

2.4.2 Alternative scenarios of development

A. Manitoba Hydro shall submit to the Panel the analysis of at least the following five sequences of developing its future generating capacity:

1) the proposed development scenario;
2) a) substantial delay in Ontario sale /predominantly hydro development,
   b) substantial delay in Ontario sale /predominantly non-hydro development;
3) a) no Ontario sale /predominantly hydro development,
   b) no Ontario sale /predominantly non-hydro development.

B. Within the constraints of the above, Manitoba Hydro shall determine, for each scenario, the most feasible succession of hydro and non-hydro components and discuss why they were selected in favour of others. A significant parameter for comparing the five scenarios with one another shall be the net financial cost, that is, the total discounted financial costs of future power supply minus the financial benefits to Manitoba Hydro from power export. It is understood that whenever scenarios are compared to one another, the significant parameters shall have been calculated with the same assumptions regarding load growth, discount rate, and other sensitive variables.

C. The Proponent shall present this analysis in reasonable detail, with simplicity, and supported by effective figures, tables and graphs. Figure 1 (which follows Section 8.), prepared by the Panel from information published by Manitoba Hydro, is presented as a suggested model. The tables shall show the significant cost figures in 1992 dollars, for each scenario and for each year over the period of analysis. There shall be clearly understandable explanations and sample calculations so that the reviewer can evaluate all pertinent aspects when comparing the scenarios with one another.

2.4.3. Sensitivity analysis

A. The analysis of the alternative development scenarios shall be extended to determine how the five scenarios discussed in the foregoing subsection would perform under changed assumptions. These shall include, but not be limited to, the following:

1) discount rates that are 2% higher and 2% lower than the one that was used;
2) a demand side management program that is 50% more effective and one that is 50% less effective than the one that was assumed;
3) demand side management costs that are 20% higher and 20% lower than the ones that were assumed;
4) the capital and operating costs of Conawapa to be 20% higher and 20% lower than estimated, in real terms;
5) the fuel costs of gas turbines to be 20% higher and 20% lower than were assumed, while keeping all other costs the same;
6) purchases and exchanges from other utilities 25% higher and 25% lower than what was assumed;
7) changes in Manitoba's load growth, assuming Manitoba Hydro's medium-high and medium-low forecast, as well as the National Energy Board (1991) estimate of 4045 MW in the year 2010, and continuing at the same rate of growth thereafter;

8) a reduction in stream flow as a result of the Provinces of Alberta and Saskatchewan making full use of their stream flow entitlements on the Saskatchewan River as well as on the Churchill River; and
9) reduction in long-term average stream flow conditions on the Nelson River and the Churchill River of 20%, as a result of possible climatic change.

B. It shall be understood that some of the changes defined in the above (such as a change in load growth or a change in stream flow conditions), may require some internal change in scheduling and timing of the various components of a scenario. Such changes must be accommodated before the indicative parameters are calculated. The results of this sensitivity analysis shall be presented in the same format as discussed in section 2.3.2.

2.5 Financial and rates analysis

A. The Proponent shall discuss how the financing of the proposed development scenario and the alternative development scenarios will take place and what implications that financing will have for the total provincial debt and for the credit-worthiness of the Province of Manitoba.

B. The Proponent shall also discuss the financial costs and benefits of the Project to the Manitoba taxpayer and the extent to which any long-term debt must be borne by the taxpayer.

C. The Proponent shall evaluate the differences in annual tariff levels in Manitoba between the proposed development scenario and the alternative development scenarios for the period 1992-2022, as described in Sections 2.3 and 2.4.

3. PROJECT DESCRIPTION

A. This section shall include a description of the proposed Conawapa Project and its ancillary components. It shall include: the principal plans, profiles and cross-sections, showing topography, scales, elevations and dimensions of all components of the Project; the time table and method of construction; the manner in which the ***forebay***, the power house, the ***spillway***, the ***converter stations*** and the transmission lines are to be operated; and the functions that the Conawapa Project will perform in the overall operation of the Manitoba Hydro generating system.

B. The Conawapa Project referred to in these Guidelines includes the following proposed elements:
1) the Conawapa generating station, including the power house, ***coffer dams***, spillways, dams, dikes, access road, Conawapa-Henday transmission line, and any other associated works;
2) the expansion of the Henday Converter Station;
3) the Bipole III (Henday-Riel) transmission line;
4) the Riel converter station;
5) the ***ground electrode***;
6) the Riel-Dorsey transmission line;

7) the upgrading of the Southern Receiver System between the proposed Riel Station and the St. Vital and Ridgeway Stations;
8) the Ontario Line (Riel-Ontario boundary); and
9) ancillary activities and facilities.

Maps showing possible locations of these elements of the Conawapa Project are presented in Appendix D.

3.1 System composition

A. In order to understand how Conawapa will function in the over-all Manitoba Hydro generating system, it will be helpful to understand how the entire system is composed. Using simple but effective maps, diagrams and tables, the Proponent shall provide:

1) a comprehensive summary of all the hydroelectric generating stations on the Winnipeg River, Saskatchewan River and Nelson River, including: their capacities in MW; their maximum, average and minimum plant discharge capacities in cubic meters per second (cms); their normal operating heads; their ***capacity factors*** under normal and under dry-spell conditions; the range of fluctuation of their forebays; and the storage capacities contained within those ranges;
2) a comprehensive summary of: the method of controlling Lake Winnipeg, including the functioning of the Jenpeg Control dam, the Two-Mile channel, the Eight-Mile channel and the East Channel; the permissible range of regulation on Lake Winnipeg, and the restrictions imposed on minimum and maximum outflows and on the rates of change of outflows; and the ***storage capacity*** contained within the permissible range of regulation;
3) a comprehensive discussion of the method of controlling Southern Indian Lake, including: the functioning of the Missi Falls control dam and the Notigi control dam; the permissible range of regulation on Southern Indian Lake, and the restrictions imposed on permissible minimum and maximum outflows and on the rates of change of these outflows; and the storage capacity contained within the permissible range of regulation;
4) a comprehensive presentation of all the transmission lines and their associated stations, structures and equipment, which convey the electrical energy from the generating stations to the consumers, including all export and power exchange destinations (the labelling of the transmission lines shall include their respective capacities in MW); and
5) a provisional presentation of the sequencing, location, and plans of the proposed hydroelectric additions to the system to be undertaken within the projected lifetime of the proposed Conawapa Project.

3.2 General layout of Conawapa Project

A. The Proponent shall describe the proposed Conawapa Project, including the design, construction, operation and maintenance of all elements. The following sections describe the desired topics of this presentation. Ample use shall be made of ***topographical maps***, ***Landsat images***, and aerial photographs of suitable scale to show proposed Project locations. Those same or other maps shall indicate dwellings, villages, towns, cities, roadways, access routes, winter roads, utility corridors, hunting or trapping lodges, and any other

man-made structures that may have some bearing on, or that may be affected by the Project.

B. The Proponent shall discuss the adequacy of proposed plans and procedures for the transportation, handling, storage and disposal of dangerous goods and hazardous materials, and for response to environmental accidents and emergencies.

C. Manitoba Hydro shall describe measures that will be taken to protect the ***health*** and safety of workers and the general public in and around its facilities.

D. Manitoba Hydro shall also describe: the living accommodations, water supply, sewage facilities and recreational opportunities that will be provided for the construction workers; the subsequent removal of these facilities; and the environmental clean-up of the construction camps and their access roads and air strips.

3.2.1 Conawapa Generating Station

A. This presentation shall begin with a description, including topographical maps, profiles, cross-sections, aerial photographs and land-based photographs, of the pre-development and present condition of the Nelson River at the Conawapa dam site and forebay area. It shall describe the natural (pre-1970) flow regime and the present flow regime during summer and winter, on a seasonal as well as daily basis, and explain the associated erosion patterns that are evident along the river banks.

B. A general presentation shall then be made of the functioning of the Conawapa Generating Station, including the main elements of the power house, the spillway, the forebay, the transmission facilities to Henday, and the access road from Sundance.

C. After this general introduction, detailed information shall be provided, including but not limited to the following:

1) a detailed description of the method and the timing of constructing the dam, powerhouse and spillway; the use of coffer dams and their subsequent removal;
2) topographical maps and aerial mosaics of suitable scale showing the proposed Project location, including the transmission line corridors and converter station sites; the maps should also show the proposed roadways, access routes, substations, work camps, power sources and utility corridors;
3) plans and descriptions of the proposed dam facilities, including: dykes, spillways, coffer dams, power facilities, intake and discharge channels and structures, proposed fish passage facilities, spawning channels and/or hatcheries;
4) maps of the proposed reservoir area, showing: 2-meter contour lines between the river bed and the elevation of 30 meters above the proposed reservoir level, but not necessarily beyond a distance of 300 meters from the edge of the reservoir; the boundaries of the river channel at low water level, at high level and at ice-jam level under natural conditions; the boundary of the proposed maximum reservoir level; the nature of the shore line vegetation; the location of dykes,

control dams and diversion channels; the entire length of both the augmented and the diminished tributary stream channels; and the proposed areas of shoreline clearing;

5) a description of the extent of clearing, excavation, quarrying, and earth-works for the Conawapa generating station and identification of the borrow sites for local construction materials, such as sand, gravel, clay and stone, and their removal and transportation methods;
6) estimates of quantities of toxic substances that may come from these construction activities and from construction camps, and the proposed control of these substances;
7) proposed construction methods that could have adverse effects on the environment, such as methods of placing and removing coffer dams, extent of dredging, clear-cutting, diversion techniques, and large-scale earth removal; and a discussion of possible alternative construction method(s); and
8) a plan for environmental surveillance and monitoring during the construction.

3.2.2 Bipole III

A. There shall be a general presentation, in simple language, of how electricity is generated in Conawapa, transmitted to Henday, converted to direct current (D.C.), transmitted to Riel, converted back to alternating current (A.C.) and delivered to customers.

B. The Proponent shall describe the principal features of the design, construction, operation and maintenance of:

1) the proposed expansion of the Henday Converter Station;
2) the proposed Henday-Riel transmission line;
3) the required ***rights-of-way***, including the methods to clear and maintain rights-of-way and the methods of disposal of cleared vegetation including any merchantable timber;
4) the transmission towers, including tower and line heights, spacing intervals, and river and stream crossings; and
5) the crossing of the Lake Winnipeg Narrows.

C. The method of construction, including the type of equipment, the location and type of access roads and camps and related ***infrastructure*** and the seasonal timing of construction shall also be discussed.

D. The Proponent shall discuss the methods and criteria that led to the present selection of alternative corridors, the advantages and disadvantages of each corridor option, and the extent to which the present choice of alternative corridors has taken place in consultation with local communities.

E. The Proponent shall comment on the suggestion offered by a participant, that an additional corridor from Henday to the vicinity of Norway House and from there to Poplar River be considered. The Proponent shall also discuss the reason why direct corridors to Dryden, Ontario and to Brandon, Manitoba, were not included in the Conawapa proposal.

F. The Proponent shall discuss the future route selection process within the chosen corridor, including the proposed planning and approval process, and the opportunities for public participation in the evaluation of alternatives.

G. The Proponent shall provide adequate information on the design, construction and maintenance of the transmission lines. This shall include:

1) the crossing of creeks, particularly those that are open all year round;
2) the construction of ***ice bridges***;
3) vegetation clearing and control practices, particularly near water courses and other sensitive habitats;
4) the manner and extent of vegetation clearing near streambeds; how damage to the soil profile will be avoided and vegetation control be maintained during construction and maintenance of rights-of-way, particularly in areas of native prairie grasslands; and
5) the extent to which human health considerations have played a role in the design and siting of transmission lines and converter stations.

H. The Proponent shall present a comprehensive risk assessment of Bipole III going either east or west of Lake Winnipeg, as will be discussed in Section 3.6.

3.2.3 Riel Converter Station and related works

A. In this section the Proponent shall describe the Riel Converter Station, the ground electrode, the Riel-Dorsey transmission line, the upgrading of the Southern Receiver System between the Riel Station and the St. Vital and Ridgeway Stations, the infrastructure, and the criteria for site selection for each of the above. The size of required rights-of-way and station sites shall be included.

3.2.4 Ontario Line

A. The Proponent shall discuss the design, construction and maintenance of the Ontario Line in a manner comparable to the presentation of Bipole III.

B. Manitoba Hydro shall report on the progress of the Ontario-Canada Environmental Review of the proposed border crossing, and the coordination of the selection and approval of a common border crossing.

3.3 Construction schedule and cost estimate

A. The Proponent shall submit a detailed construction schedule for all elements of the Conawapa Project. The first date of this schedule shall be the day that approval of the Project is received. An important intermediate date shall be when the first power can be delivered to Ontario. The final date shall be when the entire Project is completed.

B. Manitoba Hydro shall discuss to what extent this schedule is influenced by the time of the year that approval is received.

C. The Proponent shall calculate and explain in detail the expected Project cost (capital and environmental), in terms of 1992 dollars. The day that the entire Project is completed shall be the reference date for all calculations. The Project cost shall include:

1) all the anticipated construction costs of each of the Project elements, listed in the introduction to this section;
2) the contingencies that may arise during construction;
3) the cost of engineering and ***owner's overhead***;
4) interest during construction, calculated with a ***net interest*** rate;
5) the costs of all proposed environmental ***mitigation*** and ***compensation*** measures, directly associated with the Conawapa Project;
6) the equivalent cost of the residual environmental impacts that cannot be compensated, including the ***option value*** of natural resources that are adversely affected by the Project; and
7) any portion of the total past and future infrastructure and environmental costs of the Lake Winnipeg Regulation, the Churchill River Diversion and associated works, allocated to the Conawapa Project.

3.4 Operation and maintenance

3.4.1 System operation

A. Following from Section 3.1, the Proponent shall discuss in detail: why, when and how water is released from Lake Winnipeg and Southern Indian Lake; what this does to the levels of Cross Lake and the Burntwood River; what role is played by Sipiwesk Lake; what the combined releases do to the levels of Split Lake; when the released flows arrive in the forebay of the Kettle Generating Station; and in what manner the water is permitted to flow through the Kettle, Longspruce and Limestone facilities.

B. The Proponent shall discuss in detail the present practice of adhering to the regulation restrictions that were presented in Section 3.1.

C. The Proponent shall state whether a request has been made, or whether a request is contemplated, to relax the restrictions that were referred to above. If so, what is the nature of such a request?

D. The Proponent shall explain the difference between operating the system under conditions whereby the total capacity demand is relatively small when compared to the installed capacity, as it is now; and operating under conditions whereby the total capacity demand would be relatively large, as it would be if the total Manitoba peak demand were equal to the total installed capacity minus reserve requirements.

E. After this general introduction, the following historic records of ***hydrometric information*** shall be provided:

1) the average, the minimum and the maximum discharge for each month of the period 1960-1990 at: the outlet of Lake Winnipeg (Jenpeg and East Channel combined); Jenpeg alone since 1970; the outlet of Southern Indian Lake (Missi Falls and Notigi combined); Notigi alone

since 1976; and the Kettle Generating Station(before 1970 at or near the site, after 1970 at the tail race);

2) the average, the minimum and the maximum water levels for each month of the period 1960-1990 of: Lake Winnipeg; Cross Lake; Southern Indian Lake; Split Lake; Kettle forebay (after 1970); and Longspruce forebay (after 1977);
3) the ten-year average, the maximum, and the minimum water levels recorded at Lake Winnipeg, Cross Lake, Southern Indian Lake and Split Lake for the period 1960-1970 and for the period 1980-1990;
4) the average hourly discharges for a representative mid-winter week, mid-spring week, mid-summer week and mid-fall week in the year 1989, at the stations listed in 1); and
5) the average hourly water levels for the same weeks as selected in 4) and for the locations listed in 2).

F. All of the above information shall be provided in the form of tables as well as in graphical form, so that the reader can quickly appreciate what has happened to the river system as a result of regulation. The Proponent shall highlight on these tables and graphs the dates when various new water control projects were commissioned, and shall discuss the influence that these projects have had on water levels and stream flows.

3.4.2 Operation of Conawapa

A. The Proponent shall explain in general terms how Conawapa would be operated in the context of the entire Churchill-Nelson System. This discussion shall be illustrated with suitable tables and graphs. It shall include the anticipated average hourly forebay water levels and the average hourly discharges at the Conawapa dam site and at several downstream locations, with and without the Conawapa Project. These studies are to be conducted for a representative week in mid-winter, mid-spring, mid-summer, and mid-fall, once the plant is fully functioning.

B. Participants have expressed concern that the entire system would operate differently, with and without Conawapa. To examine this, the Proponent shall conduct a systems operation analysis for the following two conditions:

1) Assuming Manitoba Hydro's base-forecast load growth, and its proposed development scenario, including export of power to Ontario, and the year 2012, the Proponent shall calculate the following:
   a) The average, the minimum and the maximum discharges for each month, at the following stations: Jenpeg, East Channel, Missi Falls, Notigi, Kettle, Longspruce, Limestone and Conawapa.
   b) The average, the minimum and the maximum water levels for each month at the following stations: Lake Winnipeg, Cross Lake, Southern Indian Lake, Split Lake, Kettle forebay, Long Spruce forebay, Limestone forebay and Conawapa forebay.
   c) The average hourly discharges for a representative mid-winter week, mid-spring week, mid-summer week, and mid-fall week in the year 2012 for the stations listed in item a).

d) The average hourly water levels for the same weeks in the year 2012 for the stations listed in item b).

All of the above calculations are to be conducted assuming, respectively: extremely high river discharge conditions, average river discharge conditions, and extremely low river discharge conditions in the Nelson River and Churchill River drainage basins.

2) All of the above calculations are to be repeated, assuming alternative development scenario 3) b) (see Subsection 2.4.2 A,) and also for the year 2012.

The results of these calculations shall be shown in tables with the results of 1) and 2) side by side and on graphs, with the results of 1) and 2) in the same graph, so that the outcome of the study can easily be evaluated.

C. It would be helpful if the Proponent would also provide: daily water level data in digital form for the period of record for each of the stations listed in item B. 1) b) above; and corresponding daily water level data simulated for the period of record, on the basis of the system's being operated throughout that period in accordance with the assumptions requested in B. 1) and 2). These data should be accompanied by a program capable of making comparisons between these data sets accessible in graphical form on a personal computer.

D. Detailed information shall also be provided about the estimates of quantities of toxic substances that may be produced from operations activities, and the proposed control of these substances

3.4.3 Maintenance of works

A. The Proponent shall describe all maintenance activities that would follow the construction of the Project. In particular, this shall include the use of chemicals and other methods for the maintenance of rights-of-way. The use and maintenance of access roads shall also be included.

B. Particular concern has been expressed by certain participants regarding the use of chemical spraying of rights-of-way of access roads and transmission lines, and what effects this will have on **plants**, wild life, fish and human health. The Proponent shall identify appropriate methods and compare the annual cost of maintenance of the right-of-way of Bipole III by local labour and light equipment, with that of maintenance by chemical spraying.

3.5 Employment

A. The Proponent shall describe the required labour force and its geographical distribution for each phase of the Project, including construction, operation and maintenance. This description shall include but not be limited to:

1) duration of employment;
2) the number and types of employees;
3) the education requirements;
4) the composition of sex and ages; and

5) the proportion of northern residents.

3.6 Risk assessment

A. Many types of risk attend a development of the magnitude and potential irreversibility of the proposed Conawapa Project. First, there is the risk of error in projecting future energy needs. Given the considerable lead time required for construction, it may transpire that the Project was not needed.

B. Second, there are physical risks to the Project itself in all of its phases. For example, there is the risk of damage to the physical facilities of the Project resulting from natural forces or from human activity.

C. Third, there are financial risks involving potential losses that might result from the Project, and which should be included in its cost. For example, there is the possibility of cost overruns in the construction phase. In the same category of risks is the possibility of losses to the Proponent from legal liability for damages arising from the operation of the facility.

D. Finally, there are risks of damage to the environment during all phases of the Project. Those potential environmental impacts for which the occurrence or severity is uncertain comprise environmental risks of this type.

E. There are three related aspects to the way in which considerations of risk must enter the Proponent's evaluation of the Project and of possible alternatives:

1) the probability (or probability distribution) the Proponent attaches to the occurrence of risky events related to the Project;
2) the Proponent's estimate, where possible, of the monetary equivalent of damage from risky events related to the Project; and
3) the mathematical expectation of potential costs to Manitoba Hydro from risky events related to the Project.

F. Probability and damage estimates must be justified on the basis of past experience. The Proponent shall indicate if additional weight is given to the mathematical expectation of damage to reflect risk-aversion.

G. In Section 5 of the EIS, the Proponent is to describe and assess the anticipated adverse environmental impacts arising from the Project. In the present subsection, the general approach of Manitoba Hydro to the assessment of the risks of these adverse environmental impacts within the framework described above shall be discussed.

H. The Proponent shall describe how the risks of adverse environmental impacts that are unanticipated (so-called "nasty surprises") are incorporated into a comparison between the proposed Conawapa Project and alternatives.

I. The Proponent shall consider events which may expose the proposed Conawapa Project to risk of damage that can be expressed in equivalent monetary terms. For each risky event listed below, Manitoba Hydro shall describe its assessment of the expected damage, using the framework described above. If the Proponent's estimate of expected damage assumes a range of possible values, the probability that it assigns to the maximum,

minimum, and several intermediate values shall be described. The risky events to be discussed are the following:

1) extreme meteorological conditions, such as tornadoes, hail, ice storms, freezing rain, extreme winds, etc., causing damage to transmission lines;
2) forest fires, damaging transmission lines;
3) extraordinary geological conditions, such as earth tremors, resulting in dam failure at Conawapa, or possibly at an upstream dam resulting in a possible chain reaction;
4) damage to part of the Conawapa Project physical structure from a deliberate act;
5) undetected defects in material resulting in equipment and power outage;
6) breach of contract by Ontario Hydro, and assuming moreover that the North American economy is in such a depressed condition that there is no market for Manitoba's surplus power;
7) non-availability of contractual power to meet export commitment;
8) legal decisions respecting, or having a bearing upon outstanding land claims, the Northern Flood Agreement and Treaty rights; and
9) legal decisions with respect to claims for compensation for personal injury or other health damages, possibly based upon new evidence, arising from the Conawapa Project.

J. The Proponent shall also assess the joint probability of two (or more) risky events in the list above occurring simultaneously wherever the anticipated monetary value of the resulting damage is expected to exceed the sum from the separate events. Probabilistic assessments shall be accompanied by supporting data from relevant past experience.

K. The issue of the reliability of the Proponent's domestic load forecast to the year 2028 is addressed in subsection 2.2. The question that the Proponent shall address here is: What are the risks, in quantitative and qualitative terms, that would stem from the Proponent's possible failure to forecast domestic load demand with tolerable accuracy?

L. Participants have expressed the concern that approval of the proposed Conawapa Project will increase the risk posed to Manitoba by its undiversified mix of power sources. The Proponent shall discuss this concern.

M. The Proponent shall compare the risk and security implications of each of the five corridors that have been proposed for Bipole III.

N. Manitoba Hydro shall describe the role played by considerations of risk in its decisions to enter into long-term, firm power export contracts.

O. The Proponent shall explain in detail the manner in which several of its estimates of the potential losses from delay in approval of the proposed Conawapa Project were calculated. All relevant assumptions shall be stated explicitly.

3.7 Decommissioning, restoration and rehabilitation

A. Manitoba Hydro shall describe its plan for decommissioning the proposed Conawapa Project at the end of its useful life, including its plan for restoring and rehabilitating the sites of the Project facilities. The Proponent shall

indicate the costs that would be incurred in the year that the decommissioning, restoration and rehabilitation take place, expressed in 1992 dollars and not discounted to an earlier year. The anticipated date and timetable for decommissioning, restoration and rehabilitation shall be indicated by the Proponent.

B. Manitoba Hydro shall describe in detail its plan for the restoration and rehabilitation of all sites disturbed by preliminary work related to the Project, excavation for construction and geological site testing, and all tree-clearing operations. The plan shall include a description of the proposed disposition of the access road from Sundance, Manitoba to the proposed Conawapa Generating Station construction site and the construction power line from the Limestone Generating Station to the proposed Conawapa Generating Station construction site. The Proponent shall also indicate the cost of implementing all aspects of this plan.

4. DESCRIPTION OF THE ENVIRONMENTAL SETTING

A. This section has two main purposes: 1) to describe the setting for the proposed Project and 2) to establish baseline data against which the predictions of its environmental impacts will be measured. It shall include both a broad overview of the Study Area (see Section 1.3.3) for general systems understanding, and detailed coverage to facilitate in-depth understanding of potential impacts. The detailed coverage should focus on valued environmental components in areas where a measurable change in the environment may occur by the construction, operation and maintenance, or decommissioning of the Conawapa Project or a part of it.

B. To accomplish these purposes, Manitoba Hydro shall determine, to the extent possible, the natural conditions prior to northern hydro-electric development (the baseline) and describe the evolution of the environmental system to the present. This will require the compilation or collection and the evaluation of:

1) relevant data on historical and present conditions to establish temporal trends;
2) spatial data to determine the extent of any temporal changes; and
3) quantitative data to determine the magnitude of change.

C. Research will be necessary to develop an understanding of how and why changes have occurred, and to understand and predict any cumulative impacts. This understanding is needed to distinguish between human and natural causes, to predict future conditions, and to assess the viability of potential remedial and mitigative measures. Linkages between environmental components are important and shall be identified wherever possible. A systematic appraisal of the significance and sensitivity of bioregions affected by the Project would be useful.

D. Environmental considerations for which the natural baseline is unknown or cannot be accurately determined must be explicitly identified together with any ramifications for the assessment.

E. Baseline data collection shall be used to develop indicators useful for later monitoring of environmental impacts, and for creating continuing data sets in advance of specific project initiatives (e.g. future system development). Suitable experimental control and monitoring sites and studies for later programs to monitor impacts must also be identified.

F. The information requirements listed below provide the general subject areas to be reported upon for each of the Project components. Some items in the list may be relevant only to certain components of the development, or in certain areas. The coverage of items will be based upon the Proponent's review of valued environmental components and other factors identified in the course of its work. If an item is not considered in the EIS, Manitoba Hydro must explain why it was omitted or how and when the data will become available.

G. Throughout the following subsections the spatial relationships of important aspects of the environment to the proposed Project shall be illustrated using maps of an appropriate scale.

4.1 Climate

A. The objective of this subsection is to describe prevailing climatic conditions. Of particular interest are those factors that may be altered by the Project and affect people or other ***biota***, and factors which may affect the construction, operation, or maintenance of the generating station or transmission lines.

B. The description of climate shall include but not be limited to:

1) the relationships between terrestrial vegetation and regional climatic conditions (i.e. ***ecoclimatic regions***);
2) temperature: monthly extremes and averages, multi-year variations, frequency of inversions;
3) mean and extreme dates of freeze-up and spring thaw;
4) precipitation and snow cover: monthly extremes and averages, 24 hour intensity, and multi-year variations;
5) wind: monthly extremes and averages of velocity and direction, multi-year variations;
6) influence of evaporation and transpiration on the hydrologic budget;
7) frequency of critical storm events (e.g. combinations of freezing precipitation and high winds capable of damaging transmission lines, severe lightning storms, severe wind chill conditions, or tornados); and
8) particular climatic conditions observed in the ***Project Area***, such as fog hazard zones that, when combined with the presence of transmission lines, might pose a hazard to low-flying aircraft, and unusual microclimates.

The locations of meteorological recording stations and their periods of operation shall be mapped.

C. Manitoba Hydro shall also discuss the possible process of global warming as it may relate to the Project, particularly any aspects which may affect seasonal electrical demand or runoff volume.

4.2 Air

A. The purpose of this subsection is to describe aspects of air quality which may be affected by Project construction, operation and maintenance, or decommissioning, or which may obscure the determination of Project impacts and contribute to the cumulative impacts. Examples of the former include the production of ***greenhouse gases*** or ***air ions***, and of the latter, the aerial transport of heavy metals or herbicides into the region.

B. The description of air quality shall include, but not be limited to:

1) determinations of the annual volume of greenhouse gases produced by stretches of the Nelson and Churchill rivers before and after they were impounded, and of the Nelson River between Limestone and the proposed site of Conawapa;
2) measurements of the atmospheric deposition of those herbicides that may be applied during right-of-way clearing or maintenance; and
3) measurements of the atmospheric deposition of heavy metals (e.g. mercury) in the area of the proposed forebay.

C. Profiles showing air ion concentrations and ***electromagnetic fields*** across 230 kV AC, 500 kV AC, and 500 kV DC transmission lines operating at typical and extreme loads shall be illustrated and described. The concentration of air ions and the generation of electromagnetic fields inside and outside of the Limestone Generating Station and the Henday and Dorsey converter stations during typical and extreme operating conditions shall also be described.

4.3 Land

A. The purpose of this subsection is to describe the land and geology of the Study Area, and the extent to which they have been altered by existing developments. Surfaces that may be altered by the proposed Project, natural processes that may affect the Project, and geological deposits which may be exploited for, or as a result of, the Project are particularly important. The description shall include but not be limited to:

1) the geology, physiography, and topography;
2) the rate and results of geomorphological processes such as isostatic rebound;
3) the order and main groups of soils, their thickness, geographical distribution, and physical, chemical and biological characteristics;
4) the potential for the mobilization of heavy metals (e.g., mercury, copper, cadmium) and the release of greenhouse gases (e.g., methane and carbon dioxide) from soils or permafrost that may be subject to erosion into ***aquatic*** systems or to inundation;
5) the distribution and characteristics of permafrost, stability of slopes, and potential for erosion;
6) the location and development potential of mineral deposits and of surface deposits which may provide construction material;
7) recognized geological and hydrological hazards such as land slides, mud flows and floods;
8) the bathometry and bottom substrate of the Nelson River downstream of Limestone including the Nelson Estuary; and
9) the presence of unique geological features or landforms that may be submerged or altered and which warrant protection.

B. Manitoba Hydro shall also report the rate and extent of shoreline erosion and recession that have taken place in existing reservoirs. This report shall include, but not be limited to, a series of representative cross-sections of the banks of the forebays of Kettle, Long Spruce, and Limestone. They must depict the variety of inundated bank types (e.g., height, slope, material composition, vegetation cover, distance from the dam) and their yearly recession from natural pre-flooding until the present. Creek mouths and drainage valleys (active and inactive), and areas with discontinuous permafrost and unconsolidated overburden must be given particular consideration in these reports.

C. If no precise observations have been recorded, then reasonable estimates must be made and identified as such. The accuracy of pre-inundation predictions with regard to shoreline erosion and bank stabilization shall also be assessed.

4.4 Water

A. This subsection is intended to enable readers to understand the hydrological conditions and water quality as they affect, or may be affected by, the proposed Project. It shall examine the natural and existing current and flow regimes and ice conditions, and the spatial and temporal trends in the values or concentrations of water quality parameters and of their mass flux. Of particular interest are those aspects of ***hydrology***, ice, and water quality which have changed significantly from their natural pre-development conditions and may be changed by the proposed Project. Wherever possible the causes for any changes shall be identified and explained.

4.4.1 Hydrology

A. Requirements for historical information on seasonal flows are described in Section 3.4.1. Manitoba Hydro shall describe other aspects of the hydrology which may be important to biota and people, for example: ice conditions, which may affect use of estuarine habitats by marine mammals; and sediment deposition, which may alter the productivity of bottom habitats. The description of hydrology shall include but not be limited to:

1) the circulation patterns of the Nelson estuary, including the seasonal tidal ranges, currents, and wave patterns;
2) the effects of Nelson River flow regimes on daily and seasonal temperature and salinity gradients in the Nelson estuary, including particularly the depth, extent, and characteristics of the under-ice river plume;
3) a discussion of the duration, extent, and depth of ice cover on the Nelson River downstream of Limestone and on the Nelson estuary, with a discussion of the features and progression of ice break-up and freeze-up;
4) seasonal minimum and maximum flow conditions in the lower Nelson River that are necessary for the maintenance of fish habitats and safe boat travel;
5) the effects of altered flow regimes in the Churchill-Nelson system on the safety of winter travel over the ice by people and other large mammals;
6) the rate and pattern of erosion and sediment deposition in the Churchill-Nelson system and Nelson Estuary; and

7) the seasonal flow and ice regimes, in general terms, of watercourses that cross the proposed rights-of-way.

B. This description shall also include a stream and waterbody classification system that depicts watersheds, stream slopes, groundwater outlets, and habitat types of the Nelson River and its tributary streams downstream of Limestone. In developing this system, consideration should be given to seasonal use of stream habitats by biota, existing models, and the possible future applications of the system.

4.4.2 Water quality

A. Manitoba Hydro shall describe physical, chemical, and biological aspects of water quality which are important for the continued health of the environment. Particular attention shall be given to water quality parameters that have been changed by existing hydroelectric developments, or which may be altered by the proposed Project.

B. The description of water quality shall include but not be limited to the physical and chemical characteristics of: the lakes and impoundments on the Churchill-Nelson system, including Southern Indian Lake; the Nelson River in the area of the proposed forebay and below the proposed tail race; and the Nelson estuary. It shall include an examination of the seasonal, spatial, and interannual variations in water quality (i.e. point-in-time measurements and mass flux). Specific parameters to be considered and placed in context with other natural systems in northern Canada include:

1) temperature regimes;
2) turbidity, suspended sediments, transparency;
3) conductivity, pH, alkalinity, hardness, dissolved solids;
4) colour, humic and fulvic acids;
5) major anions and cations;
6) major nutrients (silica and all forms of carbon, nitrogen, and phosphorus);
7) metals (type, form, and totals); and
8) dissolved oxygen.

C. The effects of altered flow regimes on the occurrence of microorganisms in the water shall also be described. Of particular interest are the effects of flooding and impoundment on the presence of viruses, bacteria, and parasites that can infect humans when they drink, or swim in, the water. Examples of the latter include Schistosoma and Giardia.

D. Manitoba Hydro shall also describe present and proposed use of surface and ground waters, particularly downstream of potential rights-of-way or sewage outfalls and in the vicinity of converter stations.

E. The quality and potability of domestic water supplies potentially affected by the Project shall be tested and related to the Canadian Water Quality Guidelines (Canadian Council of Resource and Environment Ministers 1987 *et seq.*).

4.5 Flora

A. The purpose of this subsection is to describe the plant life upon which people and other ***animals*** depend, directly or indirectly, for food, shelter, and other purposes. This description shall include the natural aquatic, wetland, and upland plant communities, and changes that have occurred in these communities to the present. Particularly important are those areas that should be avoided by, or may be affected by, the proposed Project. Wherever possible, the causes for any changes shall be identified and explained. The ability of species and communities to cope with change shall also be assessed.

4.5.1 Aquatic flora

A. The description of aquatic ***flora*** shall include but not be limited to:

1) the seasonal composition and productivity of phytoplankton communities in stretches of the Churchill and Nelson rivers which have been flooded, in the Nelson River above and below the proposed generating station, and in the Nelson estuary;
2) the seasonal composition and productivity of ice algal communities in the Nelson estuary; and
3) the distribution and composition of aquatic macrophyte and benthic macro algal communities downstream from Limestone and including the Nelson estuary, with an assessment of their role in providing feeding, breeding, or resting habitat for ***fauna***.

B. The consideration of aquatic primary productivity shall include biomass, the rate and efficiency of photosynthesis, and limiting factors (e.g. light, nutrients).

4.5.2 Wetland and upland flora

A. The description of wetland and upland flora shall include but not be limited to:

1) the species composition and frequency, distribution (supported by maps), and dynamics of the most common upland, wetland, and riparian plant communities;
2) the role of fires, flooding, drawdown, and erosion (including thermal erosion of permafrost) in these plant communities;
3) natural factors limiting important plant communities (e.g. nutrients and water levels for wild rice);
4) an analysis of the relative abundance and importance of plant communities to native fauna as habitat and food;
5) the occurrence of rare or unique plant communities or refugia;
6) the distribution of plant life having harvest value, (e.g. harvestable timber, wild rice, croplands); and
7) areas with vegetation having scenic, historical, or social value, particularly those where Aboriginal peoples have traditionally harvested plants for food, medicine, religious ceremonies, or other purposes.

4.6 Fauna

A. This subsection will describe the ***animal*** (i.e. invertebrate, fish, amphibian, reptile, mammal and bird) life within the Study Area. It shall include descriptions of the natural aquatic, wetland, and upland animal populations, and of changes that have occurred in these communities from pre-hydroelectric development to the present. Wherever possible the causes for any changes shall be identified and explained. Species and communities which should be avoided by, or may be affected by, the proposed Project shall be described. Those species upon which people depend, directly or indirectly, for food are particularly important. The ability of species and communities to cope with change shall also be described.

B. Manitoba Hydro shall provide information on important species, their biology, and habitat use. This description shall include but not be limited to:

1) the relative seasonal abundance and distribution of those species considered to be of significance with respect to their ecological, economic, scientific, or cultural value;
2) the biological characteristics of important populations including:
   a) age and sex structure;
   b) growth rates and measurements of physical condition;
   c) reproductive capacity;
   d) mortality rates (natural and due to exploitation);
   e) predator-prey relationships;
   f) principal parasites and disease and their effects on growth and survival; and
   g) factors limiting species distribution and abundance.
3) the location and seasonal use of habitats which are important or critical during the life cycles of these populations, in particular those used for the purposes of reproduction, rearing young, resting (staging), moulting, feeding, or overwintering;
4) the occurrence, size, and importance of migratory populations (e.g. ***anadromous*** fishes, beluga whales, woodland caribou, waterfowl), their seasonal migration patterns (routes, timing, purpose), and threats to their continued migrations;
5) the occurrence, size, and importance of any genetically distinct stocks;
6) the occurrence of rare (vulnerable), threatened or endangered species (as defined by the Committee on the Status of Endangered Wildlife in Canada or other appropriate authorities or agreements), unique species concentrations, and the locations of critical habitats shall be explicitly identified and mapped in relation to the proposed development;
7) important food-chain relationships linking aquatic and terrestrial flora and fauna; and
8) historical subsistence, commercial, and recreational harvests of fish, birds, and mammals with reference to level of harvesting effort and catches by species and location.

C. In addition, the seasonal aquatic biological productivity by benthic and planktonic invertebrates and fishes in the Nelson River and its tributaries in the area of the proposed Conawapa forebay, below the proposed tailrace, and in the Nelson estuary shall be described and quantified. The composition and diversity of these communities shall be described together with any patterns of seasonal succession and regulating factors.

D. The concentrations of any contaminants that may be released to the environment during Project construction, operation, maintenance or decommissioning must be measured in valued animal species in potentially affected areas. Trends in the bioaccumulation of these contaminants by valued animal species shall be described.

4.6.1 Mercury

A. Manitoba Hydro shall review the natural cycle of mercury and the effects of flooding in the Churchill and Nelson rivers on that cycle. It shall explain the factors that govern the availability, transport, and bioaccumulation of mercury in northern freshwater, estuarine and terrestrial ecosystems, and relate them to conditions in the Study Area.

B. Using existing studies, and to the extent possible, Manitoba Hydro shall describe the ***methyl mercury*** concentrations in water, bottom sediment, fish, and people from areas affected by Lake Winnipeg regulation and Churchill River diversion. This discussion shall include an assessment of the temporal and spatial trends in these concentrations from before hydroelectric development until they return to baseline values. The extent and means of methyl mercury transport downstream shall be discussed.

C. The Proponent shall also review current knowledge on the bioaccumulation and toxicity of methyl mercury with respect to fish, aquatic mammals and fish-eating birds, and its sublethal effects on growth, survival and reproduction.

D. Manitoba Hydro shall determine and describe existing conditions with respect to mercury in the Study Area including, but not limited to:

1) methyl mercury concentrations in all sources of water (including precipitation) for the proposed Conawapa forebay, in the Nelson River below the proposed tailrace, at the mouth of the Nelson River, and in the Nelson estuary;
2) the soil organic content and vegetation biomass which may be flooded in the proposed Conawapa forebay;
3) present rates of mercury methylation and demethylation in the proposed forebay, downstream from the proposed tailrace, and in the Nelson estuary;
4) trends in the deposition of mercury to the sediment over time, from prior to northern hydroelectric development to the present, in the area of the proposed forebay and in the Nelson estuary; and
5) present contamination levels and bioaccumulation rates in the edible tissues and organs of fish, marine mammals (e.g. beluga whales), and fish-eating bird species which are eaten by humans and which frequent the Nelson River below Limestone or the Nelson estuary.

These mercury concentrations shall be compared with those from similar northern areas unaffected by flooding.

E. The current state-of-the-art of the analysis of mercury concentrations in air, organic and inorganic soils, bottom sediment, fresh and salt water, fish, birds, and marine mammals shall also be discussed. Operational constraints to

sample collection and storage, and the limits of detection and reproducibility shall be described.

4.7 People

A. The purpose of this subsection is to describe the human setting for the proposed Project. It shall include an assessment by Manitoba Hydro of the compatibility of northern hydroelectric projects with the future needs and wants of communities that may have been or may be affected by the projects. Manitoba Hydro shall, to the extent possible, assess how past hydroelectric development may have affected the social fabric of communities. It shall also include descriptions of: community profiles; health; education and employment; land, water, and resource use; and other socio-economic considerations. Particularly important are those groups that have depended, or continue to depend, upon natural resource harvesting activities for their livelihood, and those whose way of life has been changed by past developments or may be changed by the proposed Project. Wherever possible, the causes for any changes shall be identified and explained. The ability of groups and communities to cope with change shall also be assessed.

4.7.1 Community profiles

A. Manitoba Hydro shall describe the distribution and characteristics of the human populations and their communities. This description shall include but not be limited to:

1) the seasonal and long term trends in the composition and distribution of the populations, distinguishing where appropriate on the basis of age, sex, ethnic origin, and Treaty status;
2) the location, historical background, public services, physical and political infrastructure, and housing of communities and temporary or permanent camps;
3) cultural and economic practices and activities, including social assistance;
4) seasonal and permanent employment and unemployment, and financial compensation by government agencies or others;
5) the ability of local communities to support and accommodate workers associated with the Project;
6) the present seasonal accessibility of the communities by various modes of transportation; and
7) the implications of remoteness upon the cost of living.

4.7.2 Health

A. **Health** is a state of complete physical, mental, spiritual and social well-being and not merely the absence of disease or infirmity.

B. At Community Meetings and Scoping Workshops strong concerns were expressed to the Panel about the effects of past hydroelectric development on the health of nearby residents. Many people, including those living east of Lake Winnipeg, also expressed concern that the proposed Conawapa Project could have similar effects on human health. The Panel believes that it will be

necessary to consider the linkage between past hydroelectric development and human health in order to adequately predict the effects of the proposed Project.

C. Manitoba Hydro shall describe the health status of communities which may be affected by the proposed Conawapa Project. Attention shall be given in these descriptions to communities included in the Northern Flood Agreement, before their environment was subject to hydroelectric development and from then until the present. Manitoba Hydro shall examine, to the extent possible, the effects of past hydroelectric development upon the health of those communities, in order that Project-related impacts may be better predicted. Attention shall also be given in these descriptions to the analysis of data on mortality, morbidity, family violence, suicides, and substance abuse. Where appropriate, groups shall be distinguished on the basis of age, sex, ethnic origin, Treaty status, and community. The health status of these groups shall be discussed relative to the Canadian and Aboriginal Canadian populations, and wherever possible the causes for any differences shall be identified.

D. The health care infrastructure of these communities shall also be described, including the presence and success of intervention programs (e.g. Native Alcohol and Drug Abuse Program [NADAP]) and traditional spiritual and cultural support services. The emergency response potential of each community shall also be described.

E. Manitoba Hydro shall present the current state of knowledge of the risk to human health posed by the ingestion of or exposure to:

1) methyl mercury;
2) air ions produced by transmission lines, converter stations, or other electrical equipment (e.g. ozone);
3) the herbicides used to clear or maintain road or transmission line rights-of-way;
4) electromagnetic fields produced by high or low voltage AC or DC transmission lines, converter stations, or other electrical equipment; and
5) other potentially harmful substances, such as fuels and lubricants, or emissions released during the construction, operation, maintenance, or decommissioning of northern hydro-electric developments.

F. The exposure of residents and workers to these substances and emissions as a result of existing developments shall be documented, together with any consequent health effects reported. In particular, Manitoba Hydro shall assess and describe trends in the bioaccumulation of mercury among people in communities on the Churchill and Nelson river systems.

G. At the Community Meetings, many local residents voiced concerns for their health and safety as a result of the construction, operation, and maintenance of northern hydroelectric developments. Manitoba Hydro shall describe the effects on health of fear among northern peoples that their traditional foods are contaminated with mercury or herbicides, that they may contract cancer from electromagnetic fields, that their water is unsafe to drink, and that traditional aquatic and on-ice travel and recreation are unsafe. Manitoba Hydro shall also describe the effects on health of frustration and anxiety about past hydroelectric development.

H. Measures taken by Manitoba Hydro and its subcontractors to protect the health and safety of workers and the general public in and around its projects, and corporate experience with worker and public safety during and following the development of northern hydroelectric projects shall be described. These measures shall be related to existing laws.

4.7.3 Education and employment

A. In the Community Meetings and Scoping Workshops, people frequently raised concerns to the Panel about their experiences with past hydroelectric development training and employment initiatives. Manitoba Hydro shall describe its past experience in this area. It shall also describe the opportunities for training, education, and employment that would result from the Project over the short and long term. This description shall include but not be limited to:

1) an inventory of the skill levels, work experience, and availability for training and/or employment of residents in areas that may be affected by the construction, operation or maintenance of the Project;
2) direct and indirect training and employment opportunities that may be associated with the Project;
3) the ability of existing local and regional education and training programs to prepare northerners for employment in the Project, and any assistance in this process by Manitoba Hydro; and
4) the hiring policies, criteria, and practices of Manitoba Hydro and its sub-contractors, particularly with respect to experience, preference, and eligibility as they relate to age, sex, ethnic origin, Treaty status, area of residence, and union membership.

B. Manitoba Hydro shall describe in detail its intentions and methods with respect to training and employment for the proposed Project. Wherever possible, the details of other successful working models or training and employment programs, institutions, and initiatives that Manitoba Hydro intends to emulate or use shall be described. Manitoba Hydro is encouraged to consult northern training specialists.

C. The Panel believes that it will be necessary to review the training, education, and employment initiatives related to past hydroelectric projects in order to adequately assess the effects of the proposed Project. Manitoba Hydro shall review its experiences with the training and employment of local workers for the construction, operation and maintenance of Limestone and Bipole II. This review shall include an analysis of reasons for the success or failure of any affirmative employment policy with respect to women, northerners or Aboriginal peoples; and of any measures taken to avoid sexual or racial discrimination. The number of northerners employed by Manitoba Hydro and the nature and duration of their work shall be described by age, sex, ethnic origin, Treaty status, and community and related to the Corporation's employment profile. Manitoba Hydro shall also describe northerners' perceptions of the equity of its hiring and employment practices and those of its subcontractors.

D. Concern has been expressed that a tendering system approach to local contract work may fragment northern communities due to internal competition. Manitoba Hydro shall describe its tendering process and past experience with tendering contracts in northern communities, particularly the ability of northern

Aboriginal and non-Aboriginal contractors to compete effectively for local work with southern or foreign contractors. It shall also assess the perception and sensitivity of northern communities to the tendering process, and the ability of northern Aboriginal and non-Aboriginal contracting organizations to compete with southern or foreign contractors.

E. Manitoba Hydro shall describe the Employment Preference Zone set out in the Burntwood-Nelson Agreement, and the extent to which it may apply to the Conawapa Project. Manitoba Hydro shall also describe the effects of contract and union requirements on northern preference objectives.

4.7.4 Land, water, and resource use

A. Manitoba Hydro shall map and describe the location and nature of existing and planned land, water, and resource use which may be affected by the Project. This description shall include but not be limited to:

1) the seasonality and importance, including the significance for social systems maintenance, of renewable resource harvesting activities such as:
   a) forestry: raw material use and types of production;
   b) subsistence, commercial, and sport fishing and hunting;
   c) trapping;
   d) farming; and
   e) the subsistence and commercial harvesting of native plants such as blueberries, mushrooms and wild rice, and the importance of their continued organic certification;
2) the major travel trails, routes, and modes of travel used in reaching renewable resource harvesting locations;
3) mining: past mine sites, present mining claims, areas presently being exploited or under a feasibility study, and surficial deposits of gravel or other materials which may be used for construction;
4) parks and recreation: municipal, provincial and national parks; Heritage Rivers (i.e. Hayes, Bloodvein), areas administered by conservation authorities; community recreational areas such as Weaver Lake near Poplar River; and other areas and activities;
5) tourism development: commercial lodges and outfitters, ecotourism, and culturally-based tourism;
6) sites or areas of particular cultural or spiritual significance, such as those where traditional medicines are harvested, youth are trained in traditional practices, and sacred traditional ceremonies are held;
7) the locations of historic or present grave sites, such as those on Jackfish Island and in the area of the proposed forebay, which might be inundated by flooding or disturbed by construction activities;
8) waterway navigation, particularly downstream from Limestone;
9) residential, commercial, and industrial land use;
10) paleontological, archaeological, historical (e.g. York Factory) or scenic sites;
11) different types of land ownership including: public, private, Indian Reserves, or special status;
12) other areas of special status such as ecological reserves, sanctuaries and game preserves, and International Biological Program sites (i.e. the Berens River);

13) traditional land use areas that form the resource base for isolated communities and the use patterns that have traditionally occurred and now occur in such areas by type, location, and duration; and
14) wilderness areas that may be under consideration for protection under existing or proposed federal or provincial programs (e.g. Hudson Bay Lowlands).

B. Reference to land classifications made under relevant land inventory programs and development plans should be made wherever possible.

C. Manitoba Hydro shall also discuss the extent to which Treaties and the rights and entitlements contained within them, traditional land use areas, and outstanding land entitlements affect the Conawapa Project and northern hydroelectric development in general. Both existing and outstanding land entitlements, including Northern Flood Agreement Articles 3 and 4, shall be mapped in relation to the proposed Project and to existing and proposed water power reserves. Particular attention shall be given to any outstanding land claims in the vicinity of the rights-of-way and downstream from Limestone, and to potential land use conflicts over ***severance lines***.

D. Manitoba Hydro shall examine the implications of the proposed Project in relation to Provincial land use policies; community, Reserve, municipal, and district development plans and policies; and co-management plans. The Proponent shall also describe the implications of preparing corridor assessments in the absence of integrated resource management plans or co-management Plans. In particular, Manitoba Hydro shall describe the way in which it addresses natural resources of provincial interest that have not been included to date in any provincial planning strategies.

E. The Northern Flood Agreement (NFA) was signed on 16 December 1977, between the Province of Manitoba, the Northern Flood Committee, Manitoba Hydro, and Canada. Manitoba Hydro shall describe the current status of negotiations, obligations, settlements, mitigation, monitoring, research, and compensation under the NFA. That Agreement has been variously described as a "contract" or a "modern Treaty". Manitoba Hydro shall discuss its view of the Agreement as a "contract or modern Treaty", and of the relationship between the Agreement and the Project. It shall also review the performance of past compensation programs and describe how it intends to address any outstanding matters that exist between itself and the other parties to that Agreement.

F. Manitoba Hydro shall indicate to what extent northern residents other than Treaty Indians have been compensated for the effects of past hydroelectric developments. The legal and moral arguments for and against such compensation shall be discussed, together with the effects of any differential treatment between groups on community relations. The Local Government District of Churchill shall be considered in those discussions.

G. Using existing studies and data, Manitoba Hydro shall describe the effects of altered flow regimes in the Churchill and Nelson river systems on land, water, and resource use by area residents and visitors. Particular attention shall be given in these descriptions to harvesting and recreational activities, and to the effects of increased or decreased access to resources (e.g. fish and furbearers). Local perceptions regarding the quality and availability of

natural resources and recreational opportunities before and after hydroelectric development shall also be described. Similar descriptions shall be provided for the effects of Bipoles I and II, the Dorsey and Henday converter stations, and the existing 230 kV transmission line to Ontario.

H. Concern has been expressed that property values may fall in areas near the proposed Project. Manitoba Hydro shall describe the performance of property values near past projects relative to comparable properties that are out of sight and well removed from Project facilities. These descriptions shall include representative residential, agricultural, commercial, recreational, and industrial properties near the Bipole I or II transmission lines, the 230 kV transmission line to Ontario, and converter stations.

I. Wilderness has value for its ecological and aesthetic qualities. For instance, there is value to people in the simple experience of visiting a wilderness area, particularly a fast-flowing, pristine river. As wilderness areas decrease, people may be willing to pay more for this experience. Manitoba Hydro shall describe the value of having protected wilderness areas in general terms, with particular reference to those on the east side of Lake Winnipeg.

J. Concern was raised by residents of Grand Rapids and communities along the east side of Lake Winnipeg that water level regulation has adversely affected commercial fishing in the north end of Lake Winnipeg. They cited increased fishing costs due to damage from debris, changes in currents since channelization, winterkill, warmer water in summer, lower spring water levels that prevent access to stream spawning habitats, and other factors as contributing to the problem. Manitoba Hydro shall discuss the sensitivity of commercial fishing in Lake Winnipeg to changes in the seasonal water level.

4.7.5 Other socio-economic considerations

A. Manitoba Hydro shall provide time-series data on the sources of income, from before hydroelectric development until the present, in communities that may be affected by the proposed Project. Wherever possible the data shall be on an annual basis and shall indicate, by community, income from the following sources:

1) renewable resource-based activities such as fishing, trapping, and wild rice harvesting;
2) non-renewable resource-based activities, including:
    a) seasonal and permanent employment within the communities;
    b) seasonal and permanent employment outside the communities; and
    c) self-employment;
3) financial compensation from government agencies or others (e.g. unemployment insurance, settlements under the NFA); and
4) social assistance, categorized by level of government and department within government.

Wherever possible, the types of activities used to earn income in each of these categories and any changes in these activities shall be described.

B. Manitoba Hydro shall also describe and rationalize the existing rate structure. The rates paid for electricity by communities that have been affected

by past northern hydroelectric developments or which may be affected by the Project, shall be compared with those of communities in southern Manitoba, including Winnipeg, and those in export markets.

5. DESCRIPTION OF THE ENVIRONMENTAL IMPACTS

A. Environmental impacts include both the effects of a project on the environment, and the effects of the environment on a project. It is important to recognize that aspects of the environment which affect a project may also contribute to the environmental effects of that project.

B. The purpose of this section is to predict the environmental consequences of the proposed Conawapa Project. To accomplish this, Manitoba Hydro must consider each element of the Project described in Section 3 relative to the environmental setting described in Section 4, and determine where interactions may occur. These environmental impacts shall be described quantitatively and qualitatively, and their importance to the future evolution of the environmental system judged on the basis of pre-established criteria (see Section 1.3.4). The latter judgements shall consider the capacity of the environment to assimilate the predicted impacts. There must also be an analysis of the impacts of termination or suspension of the Project, or of its components or any of their constituent elements. In predicting impacts, the Proponent shall also formulate hypotheses to be tested during follow-up monitoring and research programs.

C. Manitoba Hydro shall make a qualitative comparison of the major environmental impacts of the alternatives to the Project that were discussed in subsection 2.4.

D. Manitoba Hydro shall identify and assess impacts of each phase of the Project, including pre-construction, construction, operation and maintenance, and decommissioning. Both the direct and indirect effects of the Project must be described and assessed. Indeed, the indirect effects of the Project on people who harvest moose, for example, are no less important than the direct effects on moose habitat. The nature, magnitude, timing and duration, extent (geographical distribution), level of confidence and range of uncertainty of the predicted changes shall be described, or reasons given for any failure to do so. Terms used to describe these impacts shall be appropriately defined by the Proponent for various aspects of the environment.

E. The Proponent shall conduct an ecotoxological analysis of all potentially toxic materials, or their precursors, that may be spilled, released, created, mobilized or transported as a consequence of the proposed development.

F. Where a range of impacts may result from an activity, all of these impacts shall be described. "Worst case scenarios" should be used for assessment purposes where applicable.

G. All assessment conclusions are to be supported by credible information based on experience in Manitoba and elsewhere. The extent and nature of any knowledge gaps shall be identified, particularly where such deficiencies affect

the prediction of impacts. The spatial relationships of the proposed Project to its important impacts shall be illustrated using maps of an appropriate scale.

H. Particular attention shall be given to the impact of the proposed Project on the upstream and downstream river regime including: tributaries and the Nelson Estuary; Indian Lands and ***areas of Aboriginal Interest***; proposed and existing parks; rare, threatened or endangered species and unique species concentrations; and human health.

I. In addition to issues identified in Section 4, and to the other issues that it identifies, Manitoba Hydro shall consider issues raised in the following subsections. Some issues may be relevant only to certain components of the development, or in certain areas. If an item is not considered in the EIS, Manitoba Hydro must explain why it was omitted or how and when the data will become available.

5.1 Climate

A. Manitoba Hydro shall describe and assess aspects of climate which may be altered by the Project, and the effects that climate may have on the Project. Some issues that shall be considered are:

1) the timing and characteristics of freeze-up and break-up in the Nelson River downstream from Limestone and in the Nelson estuary;
2) the effects of impoundment and vegetation clearing on local microclimates;
3) the potential for Project components and the weather to interact and produce hazards to people or other animals; and
4) the potential for damage to facilities by critical storm events or extreme weather conditions and the environmental effects of that damage.

5.2 Air

A. Manitoba Hydro shall describe any aspects of air quality which may be affected by the Project. In particular, there shall be descriptions of any gas production resulting from impoundment, burning or ionization processes, and of any electromagnetic fields. The effects of any predicted changes in air quality, indoors or out, shall be assessed, particularly as they relate to human health and the "greenhouse effect". This potential impact should be evaluated in the context of Manitoba's net contribution to greenhouse gas emissions and the National Action Strategy on Global Warming (Canadian Council of Ministers of the Environment, 1990). The effects of interference by electromagnetic fields on radio and other communications shall also be assessed.

5.3 Land

A. Manitoba Hydro shall describe and assess the effects of the Project on land surfaces, and the ability of the Project to withstand the effects of natural geological and hydrological processes. Some issues that shall be considered are:

1) the effects of increased loading by reservoir waters on geological stability;

2) the removal, addition, or disturbance of materials at the land surface or at the bottoms of streams or waterbodies, and the effects of such activities on water quality and biota (e.g. the removal of stream gravel on brook trout spawning success);
3) the effects on unique landforms and mineral resource exploitation;
4) the potential for damage to facilities by geological or hydrological hazards and the environmental effects of that damage; and
5) the effects of increased access by humans on the land surface -- in particular, disturbances caused by off-road vehicles and heavy equipment near the water and in areas of permafrost.

B. Particular attention shall be given to the rate and extent of shoreline erosion and recession in flooded areas and near water crossings, especially near creek mouths and drainage valleys and in areas of unconsolidated overburden and discontinuous permafrost. This assessment shall include, but not be limited to, a series of representative cross-sections of the banks of the proposed Conawapa forebay. They must depict the variety of inundated bank types (e.g. height, slope, material composition, vegetation cover, distance from the dam) and their expected yearly recession from natural pre-flooding until they stabilize. These figures should be directly comparable to those prepared for Section 4.3, and applicable to the maps prepared for Section 3.2.1 C. 4). Stream crossings by rights-of-way shall also be depicted.

5.4 Water

A. The Proponent shall describe and assess the upstream and downstream hydrological conditions and water quality as they affect, or may be affected by, the proposed Project.

5.4.1 Hydrology

A. Particular attention shall be given to the effects of the proposed generating station on the daily and seasonal flow regime in the Nelson River and Nelson estuary, and to the effects of stream crossings by rights-of-way. Some issues that shall be considered are:

1) the effects of the proposed Conawapa forebay and operation of the proposed generating station on the hydrological system of the Nelson River as discussed in Section 3.4.2, particularly the impoundment of water, flooding of shorelines, fluctuations in flow volumes, and drawdown;
2) the change in daily and seasonal flow velocities and water depths in the lower Nelson River;
3) daily and seasonal circulation patterns and temperature and salinity gradients, particularly in the proposed forebay and the Nelson estuary;
4) sedimentation rates and the distribution and type of sediment;
5) the duration, extent, and depth of ice cover and the features and progression of ice break-up and freeze-up; and
6) unique physical features such as rapids or waterfalls.

5.4.2 Water quality

A. The effects of the Project on water quality shall be given particular attention. Some issues that shall be considered are:

1) the water quality parameters listed in Section 4.4.2, and their anticipated seasonal, spatial, and interannual variations (i.e. point-in-time measurements and mass flux);
2) the effects on surface and ground water potability, particularly downstream of potential rights-of-way or sewage outfalls, within and downstream from the proposed forebay, and in the vicinity of the converter stations; and
3) the extent to which the flooding of the Conawapa forebay may contribute to mercury contamination in the Nelson River System.

5.5 Flora

A. Project-related changes in the plant communities may occur indirectly in response to effects on other aspects of the environment, or directly from clearing or other activities. Manitoba Hydro shall describe and assess the anticipated effects of the Project on aquatic, wetland, and upland plant communities. The sensitivity of important plant species and communities to physical disturbances, species introductions, chemical additions, and other potential disturbances shall be described and assessed. Some issues that shall be considered are:

1) the effects of any changes in the hydrology, ice regimes or water quality on the seasonal composition and primary productivity of phytoplankton, ice algal, benthic macro algal, and aquatic macrophyte communities;
2) the consequences of impoundment on shoreline communities in the proposed reservoir;
3) the consequences of clearing or leaving trees along shorelines of the proposed reservoir, and the vegetation biomass to be flooded;
4) the consequences of right-of-way clearing and maintenance, especially:
    a) the regeneration and succession of disturbed plant communities;
    b) the amount and frequency of wind-throw in relation to the clearing width and orientation;
    c) the effects of increasing "edge habitats";
    d) any differential effects on the flora due to the seasonal timing of these activities; and
    e) the effects on wilderness plant communities of creating new dispersal routes for invasive plant species (e.g. purple loosestrife), diseases, or parasites.
5) the regeneration rates and succession of plant communities disturbed by fire or vehicular traffic (e.g. off-road vehicles);
6) the loss or gain of key habitats and food resources for fish and wildlife;
7) the loss or gain of plant life harvested by people (e.g. harvestable timber, wild rice, croplands);
8) the effects of improved access and vegetation clearing on the harvest of plant species and the occurrence of forest fires;
9) rare or unique plant communities or refugia; and
10) the effects on vegetation having scenic, historic, or social value -- particulary those where Aboriginal peoples have traditionally harvested plants for food, medicine, religious ceremonies, or other purposes.

B. The impacts of various methods of clearing and maintaining rights-of-way shall be described and their impacts assessed relative to one another. If Manitoba Hydro proposes to use herbicides, then it must describe the application procedures and frequency, type, quantity, persistence, toxicity, fate, and mobility in air, water and soil for each herbicide. Methods used to warn people of herbicide spraying must be described in detail. The economic consequences of using herbicides near crops such as wild rice and blueberries that may be marketed as organically grown shall also be assessed.

C. The effects on plants, of other substances that may be released to the environment as a result of the Project (e.g. those used for de-icing or dust control) shall also be described and assessed.

D. Manitoba Hydro shall describe its plans for the use or disposal of cleared trees, particularly merchantable timber, and assess the impacts of the possible methods relative to one another. The effects on wood borer beetle populations of not disposing of cut wood, and their effects on surrounding forests, shall also be assessed.

5.6 Fauna

A. Manitoba Hydro shall describe and assess the anticipated effects of the Project on aquatic, wetland, and upland animal communities. Project-related changes in these communities may occur indirectly in response to effects on other aspects of the environment such as the hydrology, land and flora, or directly as a result of flooding or other activities. Some changes may occur in fish and wildlife populations, while others may occur in the micro-organisms and invertebrates that they depend upon for food. The health of brook trout, sturgeon, woodland caribou, and beluga whale stocks are of particular concern, as are the levels of mercury in species harvested for human consumption.

B. Animal populations depend on access to suitable habitats for their continued well-being. Manitoba Hydro shall assess the impacts of the Project on the presence of suitable habitats and on the access of animal populations to those habitats. It shall also assess the impacts of any changes in habitat quality or availability on the animal populations and their harvest potential by humans. Seasonal differences in habitat use and in Project-related activities must be taken into account when assessing the potential impacts. The sensitivity of important animal species and communities to habitat disturbances, species introductions, chemical additions, and physical structures shall also be described and assessed. Some issues that shall be considered are:

1) the effects of changes to the physical and chemical environment and to the flora on the continued suitability of important or critical animal habitats, in particular:
   a) the temporary or permanent loss, gain, or disruption of habitats which are important or critical during the life cycles of important fish or wildlife populations, in particular those used for the purposes of reproduction, rearing young, resting (staging), moulting, feeding, or overwintering;
   b) fish and marine mammal habitats in the proposed forebay, below the tailrace, and in the Nelson estuary (e.g. instream flow needs

for sturgeon and fish larvae; ice habitats for seals; estuarine habitats for beluga whales);

c) shoreline and nearshore habitats used by nesting waterfowl, shorebirds, bald eagles, beavers, muskrat, and moose;

d) the creation of new permanent, artificial edge and grassland habitat, which may serve as a travel corridor, pose a barrier to movements, or increase the visibility of animals to predators, including humans;

e) the temporary or permanent displacement or disturbance of sensitive species by noise, pressure, or light from detonations, machinery, transmission lines, or other activities or structures; and

f) the safety of water or ice crossings by large mammals (e.g. caribou).

2) the effects of facilitating or preventing access by animal populations to habitats (e.g. through alterations to the seasonal flow regime or water level, right-of-way clearing, or physical barriers such as the dam), in particular:

a) the loss of access by animal populations to important or critical habitats through the temporary or permanent blockage or disruption of movements or migrations (e.g. movements of anadromous brook trout to spawning habitats in tributaries of the proposed forebay);

b) new or improved access by predators and competitors, including humans, to previously inaccessible fish and wildlife populations and their important or critical habitats (e.g. human access to woodland caribou habitats);

c) the dispersal of parasites or disease between populations or species (e.g. brainworm transmission from southern white-tailed deer populations to woodland caribou); and

d) access to potentially dangerous areas (e.g. movements of polar bears or caribou near settlements);

3) the effects on relative and absolute abundance, diversity, distribution, succession, and biological productivity of animal communities, in particular:

a) the disruption of food chains through loss of feeding habitats or prey species;

b) the damage or destruction of species resulting from their interactions with structures (e.g. birds striking transmission lines, fish passing through turbines or over spillways) or from Project activities (e.g. blasting or clearing);

c) the effects on the biological characteristics of important species (as listed in Section 4.6 B. 2));

d) the effects of toxic substances which may be released to the environment (e.g. herbicides, air ions) or by the environment (e.g. mercury), and of electromagnetic fields; and

e) the effects on rare (vulnerable), threatened and endangered species, unique species concentrations, and genetically distinct stocks;

4) the effects on harvestable resources, in particular:
   a) the loss or gain of fish, mammal, or bird species harvested by people for subsistence, commerce, or recreation (e.g. brook trout, fur bearers, waterfowl);
   b) the availability of harvestable species;
   c) the quality, desirability, and marketability of harvestable species in terms of their physical condition, bioaccumulation of toxic chemicals, and levels of parasitism.

C. The toxicity of contaminants which have the potential to be mobilized or released to the environment -- in particular, methyl mercury and any herbicides used to clear or maintain the rights-of-way -- shall be described and assessed for representative species of invertebrates, fishes, amphibians, reptiles, mammals, and birds. Trends in the bioaccumulation of these contaminants by valued animal species shall be predicted and described.

5.7 People

A. The purpose of this subsection is to describe and assess the impacts of the proposed Project on people. These impacts may be direct, or they may result indirectly from Project-related impacts on other aspects of the biophysical environment. Manitoba Hydro must first evaluate the extent to which the people most directly affected by the Project are willing to assume the inherent costs and inconveniences of the Project. Their attitudes, positive or negative, toward the Project will influence its impact on society.

B. In the Community Meetings and Scoping Workshops, local residents attributed many social problems to past hydroelectric developments. Many people expressed fear of further developments, and unhappiness with their past experience with Manitoba Hydro, and with training and employment opportunities related to past developments. These views, however, were tempered to some extent by the desire for education and employment. It is vitally important to the assessment of social impacts that Manitoba Hydro understands the depth of feelings among Manitoba people, in order that they may be taken into account in determining the Project's social and economic impacts. In this regard, it is also important that Manitoba Hydro constructively address the variety of concerns that were expressed by people in those meetings and workshops.

C. Project-related changes in the social, economic, and cultural patterns and values may occur indirectly in response to effects on other aspects of the environment, or directly as a result of employment or other activities. The methods used to predict the impacts of these changes, as required in Section 1.3, shall be state-of-the-art and clearly described together with any assumptions. Community consultations and the role played by community elders shall be described in detail.

D. In assessing impacts, Manitoba Hydro shall test three common culturally-based socio-economic assumptions, namely, that "change is inevitable and the effects of the Project are no different from those that have [taken] and continue to take place", that "whatever problems arise as a result of the Project can be resolved by remedial measures", and that "people will be better off in the end, anyways" (Weinstein *et al.*, 1991). These assumptions

must be tested with respect to groups of different age, sex, ethnic origin, Treaty status, and geographical location.

E. The effects of the intense, relatively short-term "boom" of construction and the less sudden but longer-term effects of creating easier access to remote communities and areas are of particular interest in this assessment. Manitoba Hydro must describe and assess both these aspects of the proposed Project with respect to their short-term and long-term impacts. Also of particular interest are the impacts on groups who have depended, or continue to depend, upon natural resource harvesting activities for their livelihood, or who live in close proximity to Project components.

F. Manitoba Hydro shall consider the mixed population of the area and assess the positive and negative impacts for First Nations, Metis and non-Aboriginal people in northern Manitoba and southern Manitoba, for Canadians in other provinces, and for people outside Canada. Some issues that shall be considered are listed in the following subsections.

5.7.1 Community profiles

A. Manitoba Hydro shall describe and assess the effects of the Project on the distribution and characteristics of the human populations and their communities, in particular:

1) on seasonal and long-term trends in the size, composition and distribution of the populations, distinguishing where appropriate on the basis of age, sex, ethnic origin, and Treaty status;
2) on permanent or temporary immigration of workers to communities, and of migration by community members to work elsewhere;
3) on accessibility of the communities by various modes of transportation;
4) on community infrastructure development and seasonal and permanent employment; and
5) on the cost of living.

5.7.2 Health

A. Manitoba Hydro shall predict the effects of the Project on the health status of affected groups. Where appropriate, groups shall be distinguished on the basis of age, sex, ethnic origin, Treaty status, and community. Of particular interest in this assessment are the effects on remote Aboriginal communities, and on Project workers.

B. The effects of the proposed Project must be considered with respect to mental health, disease, toxic substances or emissions, and public and worker safety. Some items which shall be considered are:

1) the effects on mental health of, in particular:
   a) the construction "boom" with its associated relatively short-term employment and influx of workers;
   b) changes to the traditional way of life and loss of traditional livelihoods through changes to the biophysical environment, or resulting from increased access of people to remote areas;

c) any differential treatment between groups, for example in terms of employment opportunities or compensation;
d) concerns over contaminants in food and water, and over electromagnetic fields, related to the construction, operation, and maintenance of transmission lines, converter stations, and the generating station; and
e) concerns over aesthetic changes that may result from the construction, operation, and maintenance of Project components.

2) the effects on the incidence of communicable and non-communicable disease of, in particular:
a) an influx of construction workers and greater accessibility of remote areas;
b) dietary changes away from traditional foods, and of changes in water quality;
c) the effects of any loss of medicinal plant species on health and culture; and
d) the effects of any parasite introductions (e.g. Shistosoma, Giardia).

3) the effects on the health of residents, workers, and others of the ingestion of or exposure to the substances and emissions described in Section 4.7.2 E.), items 1)to 5), including also:
a) any transgenerational effects which may result from the exposure of parents to toxic substances (e.g. mercury, herbicides) or electromagnetic fields;
b) the effects of bioaccumulation; and
c) the effects of long-term exposure to one or more toxic substances or emissions;

4) the safety risks to workers and others posed by, in particular:
a) short or long term changes in hydrology on the safety of water and ice travel;
b) increased vehicular traffic and heavy equipment;
c) improved access to potentially dangerous areas; and
d) improved access by animals (e.g. polar bears).

C. The adequacy of the health care infrastructure to respond to changes in the health status and to emergencies shall also be assessed.

5.7.3 Education and employment

A. Manitoba Hydro shall describe and assess impacts of the Project on training and education, employment, and contracting patterns with particular attention to opportunities for residents of nearby communities. The rationale for any differences between past and proposed programs shall be explained. Some items that shall be considered are:

1) a comprehensive training and education strategy for the Conawapa Project, which in particular:
a) provides training and education programs that are available and easily accessible to affected peoples in remote communities, and that prepare them in advance for job opportunities;

b) provides the necessary financial, academic, and cultural support to enable Aboriginal peoples from remote communities to take full advantage of training and education opportunities (e.g. community-based programs, participation by elders, minimum numbers of trainees for mutual support);
c) helps those affected by the Project to qualify for employment on the Project, or to replace livelihoods affected by the Project with work outside the Project;
d) is responsive to the wants and needs of the affected peoples and is designed in consultation with them, and with the appropriate training agencies and educational institutions; and
e) aims at providing long-term benefits to the affected peoples and society, and increasing local employment while decreasing the reliance upon in-migration.

2) the direct and indirect employment created by the Project, in particular:
   a) the numbers, types, locations, and duration of employment opportunities;
   b) the numbers, types, locations, and duration of employment opportunities that are intended to be filled by northern Aboriginal and non-Aboriginal peoples;
   c) affirmative action programs by Manitoba Hydro and its subcontractors to facilitate the employment of those most affected by the Project at all levels including management, distinguishing where appropriate on the basis of age, sex, ethnic origin, Treaty status and geographical location;
   d) requirements for people to relocate in order to gain employment;
   e) impacts of the Employment Preference Zone set out in the Burntwood-Nelson Agreement on employment by the Conawapa Project outside the preference zone;
   f) plans for the employment of students from the affected areas; and
   g) opportunities for permanent employment of affected people with Manitoba Hydro.

3) the contracting and business opportunities for Aboriginal and non-Aboriginal northern firms, and the impacts of contract tendering on communities.

B. In addition, measures intended to meet the requirements of Section 18.5 of the Northern Flood Agreement, regarding education, training and employment, shall be described and discussed.

5.7.4 Land, water, and resource use

A. Manitoba Hydro shall describe and assess the location and nature of the predicted Project impacts on existing and planned land, water, and resource use as described in Section 4.7.4. It shall consider the impacts on people of any changes in the quantity, quality, or availability of water and renewable resources. It shall also consider the effects of opening the country and of Project construction on the aesthetics, land ownership, and land use rights. The potential future demand for alternative resource use in the Study Area, and any ***opportunity costs*** associated with the Project shall also be described and assessed. Some items which shall be considered are:

1) the effects of changes in the quantity, quality, or availability of the water and renewable resources on, in particular:
   a) the livelihoods of subsistence, commercial, and recreational plant, fish, and wildlife harvesters;
   b) the exercise of legal rights of first priority to wildlife resources, including those arising under Article 15 of the Northern Flood Agreement;
   c) family and community members who depend upon, but are unable to participate in, harvesting activities;
   d) important cultural or spiritual activities such as the harvest of traditional medicines, youth training, and the conduct of sacred ceremonies;
   e) historic or present grave sites, such as those on Jackfish Island and in the area of the proposed forebay;
   f) recreation and tourism (e.g. lodges and outfitters); and
   g) harvesters outside Manitoba (e.g. beluga whale harvesters in the Northwest Territories, caribou harvesters in Ontario, Ontario Treaty 3 residents);

2) the opening of the country, in particular the effects:
   a) of providing improved access to remote areas and communities on the east side of Lake Winnipeg, and to the lower Nelson River and its estuary (e.g. on frequency of forest fires);
   b) of changes in seasonal access by subsistence and commercial harvesters to renewable resources, and of improved access by others to the resources upon which those harvesters depend for their livelihood (e.g. access by poachers to traplines or wild rice);
   c) of improved access by others, on the exercise of legal rights of first priority to wildlife resources, including those arising under Article 15 of the Northern Flood Agreement;
   d) on community recreation areas such as Weaver Lake near Poplar River;
   e) on the preservation and value of wilderness areas such as Atikaki Provincial Park, Canadian Heritage Rivers, International Biological Program sites and other areas of special status such as ecological reserves, sanctuaries and game preserves;
   f) on paleontological, archaeological, historical or scenic sites; and
   g) on renewable and non-renewable resource development opportunities (e.g. logging and mining) and on tourism development.

3) the effects of changes in the aesthetics of the environment (e.g. through the visual impact of transmission lines or other structures, noise, light, signal interference, vehicular traffic), in particular:
   a) on the quality of life for affected people;
   b) on the wilderness perception of wild rivers on the east side of Lake Winnipeg;
   c) on recreation and tourism, especially in wilderness areas and in Federal, Provincial, and municipal parks; and
   d) on property values in the vicinity of the Project, including representative residential, agricultural, commercial, recreational, and industrial properties;

4) the effects of Project construction on land ownership and land use rights, in particular:
   a) any anticipated changes in zoning and plans for expropriation;
   b) the effects on Treaty Lands, established Aboriginal rights, outstanding treaty entitlements and land selections, and land selections under Articles 3 and 4 of the Northern Flood Agreement; and
   c) the potential for land use conflicts with Aboriginal or other peoples over severance lines or other matters.

B. Manitoba Hydro shall also assess the effects of the Project on community, Reserve, municipal and regional development plans, and on proposed management plans for Provincial and National Parks and wildlife areas. It shall describe what it views as its role in the opening of the country on the east side of Lake Winnipeg. Manitoba Hydro shall also describe the relationship between the proposed Project and the presence or absence of provincial planning strategies.

C. The Proponent shall describe opportunities for, and impacts resulting from, multiple use of the rights-of-way, i.e. use by the Project of an existing right-of-way or use of a new Project right-of-way for agriculture, silviculture, recreation or other purposes.

5.7.5 Aboriginal and Treaty rights

A. Existing Aboriginal and Treaty rights are protected by the Canadian constitution. The EIS should explain what Aboriginal or Treaty rights may be affected, whose rights may be involved, to what degree they may be affected, and how Manitoba Hydro obtained or proposes to acquire the right to affect them. It should enable the Panel to understand, and if necessary to recommend, measures capable of ensuring that no unlawful interference with Aboriginal or Treaty rights will occur.

B. Manitoba Hydro shall describe:
1) what Aboriginal or Treaty rights, of what peoples, may exist in the Study Area, and to what extent the exercise of these rights may be interfered with by construction or operation of the proposed development;
2) whether there is agreement or disagreement with these peoples as to their potentially affected rights and the extent to which they may be interfered with;
3) what rights Manitoba Hydro has acquired to interfere with the Aboriginal and Treaty rights, the nature and cost to Manitoba or any other party of obligations undertaken with respect to such acquisition, and the extent to which such obligations have been met;
4) any additional rights that Manitoba Hydro proposes to acquire to interfere with Aboriginal or Treaty rights and the nature and cost of such acquisitions;
5) the means by which Manitoba Hydro proposes to acquire any additional rights to interfere with Aboriginal or Treaty rights;
6) the persons from whom Manitoba Hydro has acquired, or proposes to acquire, such rights;
7) the period of time over which acquired rights are, or will be, affected;

8) the extent to which acquisition of rights to interfere with Aboriginal or Treaty rights has included, or will include, mitigation;
9) past experience and future projections of timeliness of such mitigation;
10) costs that have been incurred, or are projected to be incurred, by Aboriginal peoples or organizations because of Manitoba Hydro's acquisition of rights to interfere with Aboriginal or Treaty rights; and
11) whether and to what extent acquisition of such rights has caused, or is expected to cause, stress or socio-economic disruption in Aboriginal communities.

5.7.6 Other socio-economic considerations

A. Manitoba Hydro shall describe and assess the above predicted effects of development on the well-being and quality-of-life of affected peoples. The manifestation of these conditions in terms of mortality, morbidity, family violence, suicides, and substance abuse shall be discussed as part of this assessment.

B. Manitoba Hydro shall describe and assess any anticipated impacts of the proposed Project on the sources of income in potentially affected communities. Wherever possible these impacts shall be predicted on an annual basis, by community, for the sources of income discussed in Section 4.7.5. Causative factors for any predicted changes in income shall be discussed.

C. Impacts of the Conawapa Project on the electrical rates in Winnipeg, in affected communities, and in export markets shall also be predicted and described in terms of 1992 dollars.

5.8 Cumulative Impacts

A. The purpose of this section is to consider the environmental impacts of the Project as they relate to one another and to those of other existing and future projects. Particularly important in this regard are those environmental disturbances which occur too frequently in time or space for the environment to recover, and either add to one another to create progressively greater effects or interact with one another to create an effect greater than the sum of the parts. These additive and interactive effects are known as cumulative impacts. They may result from disturbances that are qualitatively similar or different.

B. Cumulative impacts are not necessarily different from other environmental impacts, but they are more difficult to predict and to manage. They tend to be missed by traditional methods of assessing the significance of development on a project-by-project basis (Orians, 1986).

C. Cumulative impact assessment is particularly important when there have been, or will be, a series of large environmental interventions close together over a short period of time. The component dams, channels, and reservoirs of the Churchill-Nelson system and Lake Winnipeg regulation system, existing and planned, are just such a series of interventions. The major hydroelectric projects, existing and planned, on drainages entering Hudson Bay and James Bay are another series of such interventions. Manitoba's major north-south and

east-west power transmission corridors and roadways are yet another series of interventions that can have cumulative impacts.

D. The effects of these developments may also interact with those from other types of developments, for example, the clearing of a transmission corridor may also have a cumulative effect when it is in close proximity to a forestry timber cutting area.

E. Where there has been a series of interventions to the environment, the environmental conditions may be in a state of flux. This makes it more difficult to predict the effects of yet another intervention, such as the Conawapa Project, since existing conditions do not provide a stable baseline against which to measure and predict the effects of change. Indeed, there may be no clear knowledge of the actual magnitude of the effects of the past projects since some important impacts may not yet have occurred. Consequently, it is important to have a clear understanding of the magnitude and trends of past and ongoing changes in the environment, in order to better predict the effects on the environment of proceeding with the Project.

F. Manitoba Hydro shall describe and assess the predicted cumulative impacts of the Conawapa Project on the environment. This will involve the determination of whether qualitatively different impacts produced by various components of the Project, and identified in the preceding subsections (5.0 to 5.7), may interact to produce cumulative environmental impacts. It will also involve determining whether the environmental impacts of the Project, cumulative and non-cumulative, may add to or interact with those of other developments to produce cumulative impacts. Activities over which Manitoba Hydro does not have control, but which may interact with the Project, shall be included in the studies, especially if the Project may have the effect of stimulating or accelerating these other proposals.

G. Existing projects and those currently under public review that must be considered with respect to their potential contributions to the cumulative effects of the Conawapa Project include, but are not limited to:

1) the existing components of the Churchill-Nelson system and Lake Winnipeg Regulation, including the Grand Rapids generating station;
2) the La Grande complex and the proposed Grande Baleine complex in Quebec, and water regulatory structures on the Moose River in Ontario;
3) Bipoles I and II and other existing linear facilities (e.g. roads, transmission lines) that would parallel or cross the proposed transmission corridors;
4) the proposed North Central Transmission Line; and
5) existing and planned resource developments (e.g. timber harvesting, mineral extraction).

H. In the assessment of cumulative environmental impacts, Manitoba Hydro shall give particular consideration to the valued environmental components, to the Nelson River and Nelson estuary, and to the bioaccumulation of contaminants.

I. The facilitation of future linear development (e.g. roads, transmission lines), hydroelectric development, and resource exploitation shall also be discussed. Particularly important in this regard are the potential for development, and the associated cumulative impacts, of a roadway adjacent to

a possible transmission line east of Lake Winnipeg, and the possible extension of the Conawapa access road to Hudson Bay.

J. Temporal and spatial trends in the bioaccumulation of contaminants, particularly methyl mercury, by animals and by people who drink the water and use aquatic renewable resources shall be described and assessed. These predictions shall be related to the effects of the Project on other aspects of the environment, to the range and mechanism of downstream methyl mercury transport, and to the effects of past projects.

K. Manitoba Hydro is encouraged to co-operate directly with Hydro Quebec and Ontario Hydro to facilitate environmental impact assessments in their respective provinces.

L. Manitoba Hydro shall cooperate with and, if possible, participate in the review of cumulative impacts on Hudson Bay initiated by Environment Canada, and in the Hudson Bay program being conducted by the Canadian Arctic Resources Committee and the Rawson Academy of Aquatic Science. Its contribution to those studies should include, in particular, information on the cumulative impacts of hydroelectric and water regulation developments on the Nelson River as they affect the Nelson estuary and coastal areas of Hudson Bay. Of particular interest are the various effects of alterations to the seasonal flow regime (e.g. on species diversity, biological productivity, beluga whales), and of any inputs of methyl mercury. The current status of the cumulative impact assessment on Hudson Bay shall be reported in the EIS.

M. Manitoba Hydro shall also coordinate its assessment of the cumulative impacts of the Manitoba/Ontario Interconnection with the work of Ontario Hydro. Results of environmental assessment studies pertaining to the Ontario portion of the proposed transmission line shall be presented in sufficient detail to permit comparisons of the environmental impacts of the alternative corridors. Manitoba Hydro shall justify its preferred border crossing with respect to the Ontario assessment.

6. RESPONSE TO THE ENVIRONMENTAL IMPACTS

A. The concepts of "mitigation", "residual impacts", "compensation", and "monitoring and research" are all intimately linked and complementary. Collectively, these concepts are designed to focus upon and address the issue of the Proponent's appropriate response to the potential adverse environmental impacts from the proposed Conawapa Project.

B. It is expected that, in its EIS, the Proponent shall identify a number of adverse environmental impacts arising from the Project. In section 6 of the EIS, appropriate responses to those impacts shall be presented, as follows:

- Section 6.1 of the EIS must describe all the mitigative measures that Manitoba Hydro intends to undertake in order to reduce the potential adverse environmental impacts;
- Section 6.2 of the EIS must describe the nature and extent of the residual impacts following the application of mitigative measures;

- Section 6.3 of the EIS must address the issue of compensation to provide further relief from, or remedy for the residual impacts following mitigation;
- Section 6.4 of the EIS must describe the Proponent's plans to undertake appropriate research and monitoring, for the duration of the Project, of the environmental impacts arising from the Project, as well as mitigation and its effectiveness, residual impacts, and compensation; and
- Section 6.5 of the EIS must describe the steps that the Proponent shall take to provide assurances about its compliance in the future with all its undertakings and all the terms and conditions that might attach to Project approval.

6.1 Mitigation

A. The term "mitigation" must be interpreted broadly, to include measures taken to eliminate, reduce or control any adverse environmental impacts or consequences arising from the proposed Conawapa Project. Mitigation shall include measures taken to enhance or prolong any potentially beneficial effects arising from the proposed Conawapa Project. Manitoba Hydro shall describe all mitigative measures that it intends to undertake to mitigate potentially adverse environmental impacts of the proposed Conawapa Project, as described in Section 5 of the EIS.

B. Mitigative measures shall include, but not be limited to, changes in the following:

1) the design of facilities;
2) the operation of facilities;
3) routing of corridors or transmission lines;
4) siting of stations;
5) water control proposals; and
6) scheduling and timing of the construction phase.

C. Where mitigative measures can be undertaken more effectively upstream from Conawapa, this course of action shall be described by the Proponent.

D. In describing its plan for implementing all mitigative measures, the Proponent shall provide a detailed description of the following:

1) who is to carry out the mitigation;
2) when it is to be carried out;
3) the manner in which it is to be carried out; and
4) the cost, expressed in 1992 dollars and described on the basis of annual expenditure for each of the years in which the mitigative measures are planned.

E. Where the Proponent proposes to undertake a mitigative measure that is both less costly and less effective than another mitigative measure in reducing environmental harm, the trade-off between the Proponent's cost-saving and the resultant greater adverse environmental effect shall be explained and a justification for the Proponent's preferred measure provided.

F. It has been suggested by participants that the operation of the Project may alter the daily and seasonal flow and water level regimes in the Nelson

River and the regulatory reservoirs, with adverse environmental effects. If this is so, Manitoba Hydro shall examine the possibility of changing the patterns of system operation to eliminate these changes. To this end, Manitoba Hydro shall examine the possibility of modifying the seasonal pattern of power delivery to Ontario.

G. Changes in flow regime that have followed Lake Winnipeg Regulation and the Churchill River Diversion are aspects of northern hydroelectric development that are causing grave concern amongst northern communities, and that may have significant impact on the lower Nelson River, the Nelson River estuary and Hudson Bay. In the natural state, the flows on the Nelson River were high in the summer and low in the winter; daily flows were nearly constant; and from day to day, changes were small. At present, average monthly summer flows are in the order of what they were prior to regulation, but winter flows are much higher than before and daily flows may fluctuate considerably. The Proponent shall assess the feasibility of the Conawapa forebay acting as a re-regulating reservoir, so that daily discharges in the lower Nelson River will cause lesser fluctuations than does the present design.

H. The Panel requires that Manitoba Hydro describe and assess mitigative measures to reduce environmental impacts from the Project upon the biophysical environment, including but not limited to:

1) the restoration and rehabilitation of borrow sites, campsites and other areas disturbed during the construction, maintenance or decommissioning phases of the Project;
2) available methods for minimizing sediment, slash, or other waste introduction to streams and water bodies, assessing their relative effectiveness;
3) the revegetation of temporarily cleared areas;
4) improvements to the design of stream crossings to facilitate seasonal fish movements;
5) scheduling of construction to avoid important or critical habitats during critical use periods;
6) minimizing wildlife harassment during construction;
7) preventing overharvesting or disturbance of fish and wildlife by Project personnel and others using Project rights-of-way;
8) replacing and rehabilitating habitat through artificial means, such as fishways and stocking programs; and
9) co-operating with the appropriate departments of the Government of Manitoba in the creation of positions for, and the training of Aboriginal "surveillance officers", whose task it would be to monitor and protect wildlife in areas rendered accessible during all phases of the Project.

I. Manitoba Hydro shall indicate how it intends to address the Department of Fisheries and Oceans' policy of "no net loss" of fish habitat.

J. Manitoba Hydro shall describe and assess the benefits and costs of clearing and maintaining rights-of-way with light equipment and local labour, as an alternative to the use of chemical spraying.

K. Fear has been expressed that ready access to the lower Nelson River would have a detrimental impact on the ecological balance of the river and estuary. Concern has also been expressed about the increased access to vulnerable herds, such as woodland caribou, that the Bipole III line might grant

to people and other animals. Manitoba Hydro shall describe what measures it intends to take to address these problems. It shall also discuss measures to prevent the public from using the access road to Conawapa in the event that the Project is delayed.

L. The Proponent shall describe and assess its plans for avoiding the addition of mercury and mobilization of methyl mercury. An effective measure may be the elimination of vegetation from shorelines that are to become inundated. The Proponent shall estimate the cost and benefit of clearing the entire Conawapa forebay area of all trees and major vegetation up to the contour line where shoreline erosion may take place over the lifetime of the Project, as indicated in Section 5.3. Since it may not be possible by this means to eliminate all methyl mercury mobilization, the Proponent shall estimate the cost and benefit of further mitigation through the removal of vegetation from the eroding shoreline upstream from Conawapa.

M. The Proponent must describe and assess mitigative measures to deal with potentially adverse impacts of the Project upon people, as described in Section 5.7.

N. Manitoba Hydro shall describe its plan for dealing with the mitigation of unanticipated adverse environmental events that may result at some future date. The plan shall have due regard for the Proponent's past experience.

O. Previous hydroelectric developments in Manitoba have involved foreign sub-contractors. If it is possible that foreign sub-contractors will participate in the proposed Conawapa Project, the Proponent shall delineate responsibility for any and all environmental damage that may be caused by foreign firms, their agents (such as foreign personnel), or by foreign equipment. The procedure whereby any individual or group can seek redress for environmental damage caused by foreign firms, their agents or equipment shall be described by the Proponent.

P. The Proponent shall also describe any plans it may have to provide the personnel involved in the Project, including those of foreign and domestic sub-contracting firms, with environmental briefings and environmental education.

Q. Where mitigative measures are limited by jurisdictional or other boundaries beyond the control or capabilities or Manitoba Hydro, the Proponent shall discuss these boundaries and suggest how mitigation might be accomplished and by whom.

6.2 Residual Impacts

A. Residual impacts are the adverse environmental effects which remain after mitigative measures have been applied. The Proponent must describe in detail the nature, magnitude, timing, duration, and extent of residual impacts of the Project that are anticipated, distinguishing between unavoidable residual impacts and those that are potentially avoidable but are considered to be too costly, in relation to their adverse environmental impact, to justify their elimination. The Proponent shall provide a rationale for such classification on a case by case basis.

B. The residual impacts anticipated from the Project should be described and categorized as "significant" or "insignificant", "direct or indirect", and whether of "short-term or long-term" duration. The criteria used by the Proponent to categorize residual effects as either "significant" or "insignificant" shall be described explicitly.

6.3 Compensation

A. The purpose of compensation is to provide a remedy, either in money or in kind, for the residual impacts of the Project (i.e. impacts that are not avoided by mitigation). Where compensation relates to interference with Aboriginal or Treaty rights, it is assumed that Manitoba Hydro has acquired the right to interfere in exchange for compensation. Manitoba Hydro shall describe what compensation measures are planned for each residual impact that is anticipated from the Project.

B. In describing its plan for implementing all compensation measures, the Proponent shall provide a description of the following:

1) who is to carry out the compensation;
2) when the compensation is to be carried out;
3) the manner in which compensation is to be carried out; and
4) the order of magnitude of the cost of compensation, expressed in 1992 dollars, including an explanation of how this was estimated.

C. As part of the compensation plan, consideration shall be given to the creation of an "environmental contingency fund" in order to respond in a timely way to unanticipated environmental damage that may arise from the Project. Based upon past experience with compensation claims arising from unanticipated environmental damage from northern hydroelectric development, the Proponent shall discuss the appropriate magnitude of such a fund and suggest how it might best be administered. In particular, and without limiting consideration of other aspects, Manitoba Hydro shall describe the mechanism through which the process of compensatory redress would be initiated, and how disputes with respect to the appropriate level of compensation for unanticipated damages to individuals or communities would be resolved.

D. The Proponent shall describe the implications of the Northern Flood Agreement for compensation arising from the Conawapa Project.

E. It has been suggested to the Panel that there is an ethical question with respect to the different regional distributions of the environmental benefits and costs from the Project. The people of southern Manitoba benefit from the exploitation of the water resources of northern Manitoba through hydro-electric developments such as the proposed Conawapa Project.

F. Aboriginal residents of northern communities have stated to the Panel that they are gradually losing their historic way of life, partly because of the change in use of the water resources of northern Manitoba. Furthermore, it has been argued to the Panel that, in the absence of adequate measures to redress this regional imbalance, some northern residents have been losing the spirit of initiative, enterprise, creativity, self-reliance, self-sufficiency, self-confidence and self-respect.

G. Manitoba Hydro shall examine and discuss these ethical issues, and suggest an approach for dealing with them.

6.4 Monitoring and research

A. The Proponent shall describe in detail its plan for undertaking continuing research on, and monitoring of, environmental impacts arising from the proposed Conawapa Project. If, in the future, adverse environmental impacts differ from those predicted in the EIS, the research and monitoring activity must observe this so as to enable the Proponent to respond appropriately.

B. The Proponent shall describe its present monitoring requirements with respect to its existing hydro-electric developments in northern Manitoba.

C. The objectives of the Proponent's monitoring and research program for the Conawapa Project shall be:

1) to test the accuracy and validity of Manitoba Hydro's hypotheses with respect to predicted environmental impacts;
2) to identify unpredicted environmental impacts; and
3) to test the effectiveness of mitigative and compensative measures.

D. To accomplish this, Manitoba Hydro shall:

1) collect relevant environmental data that were not available when the EIS was prepared;
2) collect data on Project construction and operation;
3) collect relevant data on environmental conditions during and following Project construction;
4) analyze and interpret the above data; and
5) disseminate the results of these studies.

E. The Proponent shall describe how the research and monitoring program will use traditional knowledge, how it will involve local people in its planning and implementation, and what resources (human and financial) are to be allocated to it annually.

F. In designing monitoring and research studies, every effort must be made to ensure that the methodologies used are compatible with those used in the preparation of the EIS and permit valid comparisons of the data from each.

G. The Proponent shall indicate how it will respond, in terms of mitigation and compensation, to results of the monitoring and research programs.

6.5 Compliance

A. The Panel heard many expressions of concern in northern communities about the future performance of Manitoba Hydro in implementing mitigative and compensative measures arising from the Project. Such concerns were based upon the common view, expressed forcefully to the Panel, that past commitments and past undertakings have yet to be carried out.

B. Manitoba Hydro shall indicate, with supporting reasons, what measures it would deem to be appropriate to allay the widespread apprehension of

northern Manitoba residents about potential adverse environmental consequences of the Project in all phases, and to provide reassurance that Manitoba Hydro will comply fully with all terms and conditions which might accompany the possible approval of the Project, including mitigative and compensative measures.

C. It was suggested that the Proponent should be required to post a performance bond. Manitoba Hydro shall discuss the suggestion of a performance bond. Its dual purpose would be:

1) to encourage compliance, in all phases, with the terms and conditions that might accompany approval of the Project, and
2) to provide reassurance to all who might potentially be affected adversely if the Proponent failed to comply fully with all the terms and conditions of Project approval.

D. The Proponent shall also discuss the establishment of an independent agency to monitor and verify its compliance with all terms and conditions that might accompany approval of the Project.

E. Manitoba Hydro shall indicate where its mitigation, research, monitoring and compensation programs are cooperative with those of other governmental agencies and departments, and shall describe what mechanisms are in place to ensure their implementation.

F. Manitoba Hydro shall also indicate how it will ensure that mitigation and monitoring measures can be undertaken on Treaty Lands.

7. REPORT FORMAT

A. The Environmental Impact Statement (EIS) to be submitted by the Proponent to the Panel must be organized to reflect the topics covered in the Guidelines Sections 2 through 6. The Proponent must provide extensive cross-referencing in the EIS to facilitate the readers' understanding of the contents and to evaluate compliance with the Guidelines. Cross-referencing must include a table of concordance (i.e. EIS-to-Guidelines and Guidelines-to-EIS). Sufficient copies of the EIS must be provided for distribution to Panel members, public registries, government departments and agencies and participants.

B. The Panel acknowledges that the Guidelines require the Proponent to provide extensive information that is both technical and scientific in nature. The entire document must, nevertheless, be suitable for reading by all the participants in the review process. Understanding of the contents shall be aided by the inclusion of a glossary of all technical terms and jargon used in the text, by extensive use of maps, illustrations and graphs wherever possible to assist in the display of information, and by the provision of a detailed key-word index which clearly identifies issues and assists in easy access to subjects of interest. A sample graph is illustarted at Figure 1. which follows.

C. The EIS must include a separate executive summary in lay language, which is suitable for general distribution and provides sufficient information to cover important conclusions, explanations or recommended actions. The executive summary must be translated by the Proponent into Cree, Ojibway and

French, and sufficient copies provided to the Panel Secretariat for public distribution. Because the Aboriginal languages are primarily oral, an audio or video recording of the executive summary in Cree and Ojibway shall also be provided.

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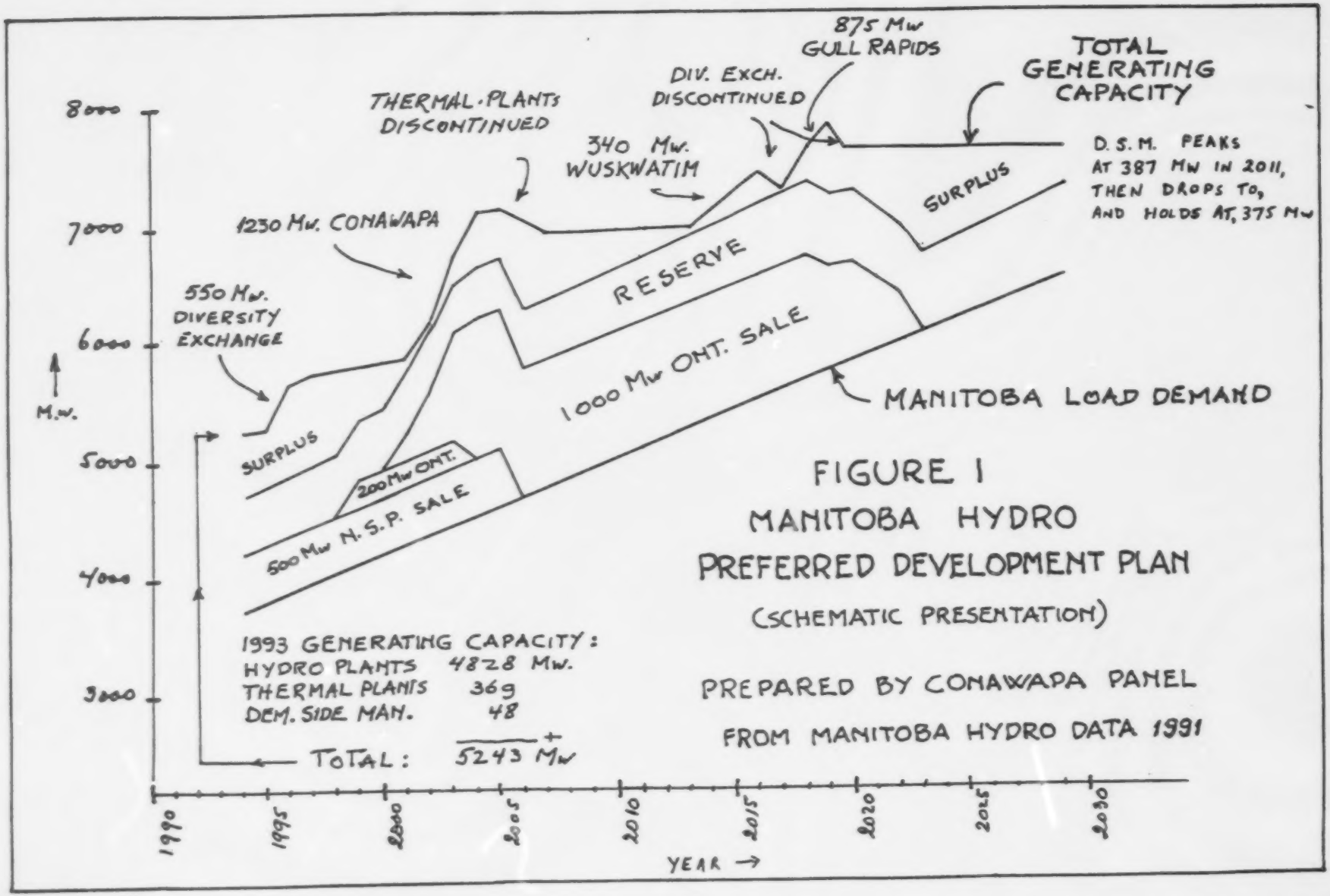

FIGURE 1

MANITOBA HYDRO

PREFERRED DEVELOPMENT PLAN

(SCHEMATIC PRESENTATION)

PREPARED BY CONAWAPA PANEL

FROM MANITOBA HYDRO DATA 1991

Canada-Manitoba Agreement on Terms of Reference for a Federal-Provincial Panel to Conduct a Public Environmental Assessment Review of the Proposed Conawapa Project

Canada

Manitoba

Appendix A

ENVIRONMENTAL IMPACT ASSESSMENT REVIEW PROCESS AND PANEL TERMS OF REFERENCE

The public review of the proposed Conawapa Project includes the following main steps:

1. Identification of issues through community meetings and scoping workshops.

2. Development of Guidelines for the preparation of the Environmental Impact Statement.

3. Preparation of the Environmental Impact Statement by Manitoba Hydro.

4. Review of the Environmental Impact Statement by the Panel and the public.

5. Public hearings by the Panel.

6. Preparation of a report to the Ministers by the Panel.

The Panel has completed Step 1. These Guidelines constitute the product of Step 2.

More information about the review process is contained in the Panel's "Operational Procedures" (September, 1991) and in the "Stage 1 Review Procedures" (May, 1992) which may be obtained from the Panel Secretariat.

This Appendix includes a copy of the Panel's Terms of Reference, entitled: "Canada-Manitoba Agreement on Terms of Reference for a Federal-Provincial Panel to Conduct a Public Environmental Assessment Review of the Proposed Conawapa Project".

CANADA MANITOBA AGREEMENT ON TERMS OF REFERENCE FOR A FEDERAL - PROVINCIAL PANEL TO CONDUCT A PUBLIC ENVIRONMENTAL ASSESSMENT REVIEW OF THE PROPOSED CONAWAPA PROJECT

Background

Manitoba Hydro is proposing to proceed with the Conawapa Project involving development of the Conawapa generating station on the Nelson River, Bipole III transmission line and convertor stations and the transmission line to Ontario.

A licence is required pursuant to the Manitoba **Environment Act** as the proposed project falls within the category of a Class III development in accordance with Manitoba Regulation 164/88. Public hearings will be required under the provincial assessment process. In addition, the federal Minister of the Environment has been requested by the Minister of Fisheries and Oceans to appoint an environmental assessment Panel to conduct a public review of the proposed Conawapa project under the **Environmental Assessment and Review Process (EARP) Guidelines Order.**

The Conawapa Environmental Assessment Panel (Panel) has been established in accordance with the Manitoba **Environment Act** and Regulations and under authority of the federal **EARP Guidelines Order**. These Terms of Reference for the Panel are issued jointly by the federal and Manitoba Ministers of the Environment.

Project Description

The proposed Manitoba Hydro Conawapa project consists of the design, construction, operation, maintenance and decommissioning of the Conawapa generating station (cofferdam, dam, spillway, powerhouse, Conawapa-Henday transmission line), expansion of the existing Henday Converter Station, new Riel Converter Station and new ground electrode, new Riel-Dorsey transmission line, upgrading of the Southern Receiver System between the new Riel Station and the existing St. Vital and Ridgeway Stations, the new Henday-Riel and Riel-Ontario transmission lines, and ancillary activities and facilities.

Panel Membership

The Panel will consist of a chairperson and five members, one of whom will be an alternate chairperson who are appointed by both the provincial Minister of the Environment and the federal Minister of the Environment. All members will be unbiased, free of any potential conflict of interest relative to the proposal under review, free of any political influence, and will have special knowledge or experience relevant to the consideration of its anticipated environmental effects.

Mandate of the Panel

The Panel shall conduct a public environmental review of the proposed Conawapa project in two stages.

In Stage 1, the Panel shall review and make recommendations relevant to the approval, rejection or approval with terms and conditions of the proposed Conawapa generating station, including the cofferdam, dam spillway, powerhouse, dikes and the Conawapa-Henday collector system, expansion of the Henday converter station, upgrading of the Southern receiver system between Riel and the St. Vital and Ridgeway stations; a preferred site for the Riel station; and preferred corridors for Henday-Riel, Riel-Dorsey and Riel-Ontario transmission lines, including the acceptability / unacceptability of each border crossing corridor option identified in the proposal. The Panel shall make every reasonable effort to submit a final report to the Ministers with conclusions and recommendations on Stage 1 of the review by January 31, 1993.

Following receipt of the Stage 1 report, the provincial and federal governments shall make their respective decisions on whether the project should proceed. If there is approval or conditional approval, the Panel shall review and make recommendations in Stage 2 of the review relevant to the routing of transmission lines within approved corridors, including the linkage of the transmission line at the Ontario/Manitoba border, the final siting of the Riel ground electrode, and any other outstanding issues identified by the Panel. The Panel should make every reasonable effort to submit a final report to the Ministers with conclusions and recommendations on Stage 2 of the review by January 31, 1994.

The Panel shall make every reasonable effort to cooperate with the Ontario /Canada Environmental Assessment process to ensure an effective review of the border crossing.

The Panel may request that the Ministers review and clarify these terms of reference at any time.

Scope of the Review

The review shall examine:

-potential impacts of the Conawapa project, including measures intended to mitigate adverse impacts, on the biophysical environment, human health, land and water use, aboriginal resource use and forest and aquatic ecosystems;

-the social, cultural, health and economic impacts directly related to the environmental effects of the project; and

-implications of the proposal for land and resource related agreements.

The review shall include, but not be limited to, an examination of the issues outlined in **Attachment 1**.

As part of this examination, the Panel shall have due regard for the information, report and recommendations resulting from the Public Utilities Board Review of Manitoba Hydro's Twenty Five Year Capital Development Plan. Any environmental considerations respecting alternatives may be included in this examination.

Review Process

The review shall follow the general process outlined in **Attachment 2**.

Public Participation Program

The Panel shall conduct a public information program to advise the public of its review and to ensure that the public has access to relevant information, including the project proposal, the guidelines for the preparation of the environmental impact statement, (the EIS). and the government review of the EIS. The project proposal and all documents generated by the review will be filed in the public registries, at the Federal Environmental Assessment Review Office (FEARO), the Manitoba EcoNet, the Manitoba Environmental Council and the Manitoba Keewatinowi Okimakinak. These documents may also be filed in summary form at other locations as set out in Schedule 2 . The public will have opportunity, in both stages of the review, to participate in the identification of issues relating to the proposal, the development of guidelines for the EIS, and in public hearings and meetings.

A program of participant assistance will be provided to help the public to participate effectively in this review.

Legal and Technical Support

The Panel may retain independent legal counsel to advise and assist the Panel.

The Panel may engage technical specialists, to assist in the examination and understanding of issues. At the discretion of the Panel, these specialists may be made available to other participants to assist their understanding of these issues.

Secretariat and Cost Sharing Arrangements

Secretariat support to assist the Panel with day-to-day management of its activities shall be shared by co-executive secretaries assigned by Manitoba Environment and FEARO.

Costs associated with the public review shall be shared between Manitoba and Canada. A memorandum of understanding on cost sharing will be entered into by assigned officials representing both jurisdictions.

Attachments 1 and 2 and Schedules 1 and 2 form part of this agreement and together with the agreement, represent the entire agreement relating to the review.

The Honourable Jean Charest
Minister of the Environment
Government of Canada

Dated: 24 mai 1991

Jean J. Charest

Witness:

K. Bradley

The Honourable J. Glen Cummings
Minister of the Environment
Province of Manitoba

Dated: May 24/91

J. Glen Cummings

Witness:

ATTACHMENT 1

Issues:

The review shall include but not be limited to an examination of the following issues:

1. The site, corridor and route selection processes for the converter stations, ground electrode and transmission lines including definition of the study area, alternatives, evaluation criteria and selection of preferred sites, corridors and routes.

2. The cumulative impacts of the Conawapa Project and ancillary activities and facilities, and existing developments to the extent that they are definable and useful to describe the existing environmental situation and for predicting potential impacts on the Nelson River and the Nelson River - Hudson Bay estuary.

3. The effects of the general influx of workers, equipment and materials into previously isolated areas on residents, land, wildlife and aquatic resources.

4. Adequacy of measures proposed to mitigate adverse impacts of the project and to compensate for residual adverse effects.

5. Adequacy of proposed plans and procedures for the transportation, handling and disposal of dangerous goods and hazardous materials and for response to environmental accidents and emergencies.

6. The disposition of the access road from Sundance, Manitoba to the proposed Conawapa Generating Station construction site and the construction powerline from the Limestone Generating Station to the proposed Conawapa Generating Station construction site in the event that the Panel recommends that the project should not proceed.

ATTACHMENT 2

The main components of the review process shall be:

1. Upon receipt of the project proposal, Manitoba Environment shall notify the public through advertisements in the newspapers as set out in Schedule 1, and shall file a copy of the proposal in the public registries, with the Interdepartmental Planning Board, with the Federal Environmental Assessment Review Office (FEARO) the Manitoba EcoNet, the Manitoba Environmental Council, and the Manitoba Keewatinowi Okimakinak . These documents will also be filed in summary form at the other locations set out in Schedule 2. The advertisements will invite written comments and objections regarding the proposal.

2. Manitoba Environment shall provide to the proponent and make available to the public draft guidelines for the preparation of the Environmental Impact Statement (EIS) which will be developed in consultation with a Technical Advisory Committee (TAC) of provincial and federal representatives. The public will be provided with the opportunity to comment to the Panel on the draft guidelines, in writing and/or through public meetings.

3. As soon as possible after its appointment, the Panel shall initiate a public information program and shall establish operating procedures for the review, including such matters as advertising, preparation of the final EIS guidelines, report preparation and procedures for the conduct of public meetings and hearings. These procedures will be released to the public and filed in the public registries and other locations as set out in Number 1 above, following approval of FEARO and Manitoba Environment.

4. The Panel shall hold meetings to obtain public input in the scoping of issues that should be assessed in Stage 1 and Stage 2 of the review.

5. The Panel shall issue to the proponent and make available to the public, final guidelines for the preparation of the EIS after considering comments from the public, draft guidelines provided to the proponent by Manitoba Environment and any other information which the Panel considers relevant.

6. Following receipt of the EIS from the proponent, the Panel shall file it in the public registries, the Manitoba EcoNet, the Manitoba Environmental Council, and the Manitoba Keewatinowi Okimakinak and with the TAC and provide an opportunity for comment on the adequacy of the document. These documents will also be filed in summary form at the other locations set out in Schedule 2. The Panel shall also file a copy of the TAC review of the EIS as set out above and provide opportunity for the public to submit written comments and objections.

7. If necessary, after reviewing the EIS, the TAC report and any public comments received, the Panel may issue a deficiency statement(s) with instructions that the proponent conduct further assessment work.

8. When the Panel determines that the EIS is acceptable, it shall give reasonable notice and shall hold public hearings at Thompson, Gillam, Winnipeg and other Manitoba communities which the Panel considers appropriate.

9. Following public hearings in each Stage of the review, the Panel shall prepare a written report with conclusions and recommendations and submit it to the Manitoba Minister of the Environment and the federal Ministers of the Environment and of Fisheries and Oceans. The Ministers shall release the report to the public prior to making their decisions respecting the project.

10. Following receipt of the Panel report, governmental decisions shall be made and announced in accordance with the requirements of the Manitoba **Environment Act** and regulations and the federal **Environmental Assessment and Review Process Guidelines Order**.

11. The Manitoba Minister of the Environment may require further information from the proponent in the event that there is insufficient information available through the review for the purposes of making a licensing decision as required by the Manitoba **Environment Act**.

12. Pursuant to the Manitoba **Environment Act**, any licensing decisions may be appealed to the Lieutenant Governor in Council.

SCHEDULE 1

Winnipeg Free Press
La Liberte
Opasquia Times
Flin Flon Reminder
Flin Flon Gold Belt Gazette
Thompson Nickel Belt News
Thompson Citizen
The New Breed
The Weetama
The Interlake Spectator
The Beausejour Beaver

SCHEDULE 2

Band Councils
Community Councils
Rural Municipalities
Local Government Districts
in the affected region

Appendix B

DEFINITION OF TERMS

Following are the explanations of some terms used in these Guidelines:

The term **Aboriginal**, for the purposes of this document, includes Treaty and non-Treaty Indians, Metis, and Inuit.

Areas of Aboriginal Interest refers to areas of specific interest, including traditional harvesting areas, areas used for sacred ceremonies, burial sites, existing and outstanding land claims, etc., and is not intended to exclude other areas of interest to Aboriginal people.

Air Ions are electrically charged air molecules (e.g. ozone).

An **anadromous** fish is one that spawns and overwinters in fresh water but moves downstream into salt water in spring to feed and returns upstream in the fall.

The word **animals**, as used in these Guidelines, includes invertebrates, fishes, amphibians, reptiles, mammals, and birds.

Aquatic organisms live or grow in or near fresh, brackish, or marine waters.

The **baseline** is the natural condition prior to hydro-electric development in Manitoba.

Biomass energy is derived from the burning of biomass, such as wood, wood waste, straw or combustible municipal waste.

Bioregionalism is the study and identification of naturally occuring regions which are defined by the interaction of their ecological components.

Biota include both flora and fauna.

As proposed, the **Bipole III transmission line complex** would consist of a 500 kV DC transmission line and its associated components routed either east or west of Lake Winnipeg to carry electricity generated by the Conawapa Generating Station south to the Winnipeg area.

Capacity is the greatest power that a unit, station or system can produce, usually measured in kilowatts (kW) or in megawatts (MW).

Capacity charge is the term used in connection with the Ontario Sale and relates to the payments to be made by Ontario Hydro for the delivery

of capacity by Manitoba Hydro.

Capacity factor is the average power produced by a unit, station or system, during a certain period of time (day, week, month or year), divided by the maximum producible power.

Capital cost is the cost of the physical structure of the Project, and includes all the costs incurred in its construction until the day of its commissioning. These include payments to contractors, engineering design and supervision, and interest charges during construction.

A **coffer dam** is a temporary structure built to exclude a river or a lake from a construction site.

Compensation is payment, in money or in kind, for any residual impacts caused by the Project.

As proposed, the **Conawapa Generating Station** would consist of a dam and 1390 MW hydro-electric generating station to be located 27 kilometres downstream of Limestone on the Nelson River.

The proposed **Conawapa Project**, also referred to as the Project, consists of all components of the development that has been proposed by Manitoba Hydro and is under review by the Panel, including the Conawapa Generating Station, Bipole III transmission line complex, and Manitoba/Ontario Interconnection.

A **converter station** is an electric facility that changes alternating current (AC) to direct current (DC) or vice versa.

A **corridor** is a strip of land five to ten kilometres wide, within which a specific route for a transmission line may be selected. Manitoba Hydro has identified five alternative corridors for Bipole III.

Cumulative impacts are those effects which result from a series of additive or interactive interventions in a social or biophysical environment over time and space.

Demand side management (DSM) is the policy of promoting energy conservation through greater efficiency, and of inducing a shift in the pattern of energy consumption to off-peak times.

Discount rate is the rate of interest used to discount a future sum of money to an equivalent present value.

Ecoclimatic regions are typically broad areas on the earth's surface characterized by distinctive ecological responses to climate, as expressed by vegetation and reflected in soils and wildlife.

The **ecosystem** consists of human populations and their social, spiritual, cultural, economic, and other practices, institutions and values, as part of a life-support system composed of air, water, minerals, soil,

plants, animals and microorganisms, all of which function together to maintain the whole.

An **elder** is a person who is respected and recognized by the Aboriginal community for the wisdom and knowledge they have acquired with age.

Electromagnetic fields (EMF) are produced by the flow and use of electrical energy. They are composed of electric fields which arise from the voltage on a conductor, and magnetic fields which arise from the electrical current flowing through a conductor. Both electric and magnetic fields decrease in intensity as one moves further from their source.

Energy is the product of power and the time over which it is used and can be measured in kilowatt-hours (kW.h).

Energy charge is a term used in connection with the Ontario Sale and relates to the payments to be made by Ontario Hydro for the delivery of energy by Manitoba Hydro.

The **environment** shall be understood here in its generic sense to encompass the physical, chemical, biological, economic and social setting.

The **Environmental Assessment and Review Process (EARP) Guidelines Order** is a federal Order in Council establishing the process to be followed for environmental assessments under federal jurisdiction.

Environmental cost is the entire adverse impact of the Project upon the environment. Some impacts may be translated into monetary terms; others may be described in qualitative terms only.

Environmental effect or impact means in respect of a project:

1) any change that the project may cause in the environment, including any effect of such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by Aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and
2) any change to the project that may be caused by the environment, whether any such change occurs within or outside Canada.

An **environmental impact assessment (EIA)** is a study conducted by a proponent to predict and evaluate the environmental impacts arising from a proposed project. The purpose of the study is to guide decision making about whether the development should proceed, and if so under what conditions (including mitigation, compensation and monitoring).

An **environmental impact statement (EIS)** is the documentation resulting from an EIA.

An **expert** is anyone with special skill or knowledge, whether it be traditional, technical, scientific, or otherwise.

Fauna are the animal life of a specific area or locality.

Flora are the plant life of a specific area or locality.

A **forebay** is the reservoir immediately upstream of a hydro-electric station.

Gas turbines are energy producers that resemble jet engines connected to a generator and that can be fuelled by natural gas.

Greenhouse gases act to trap heat close to the earth's surface. They include carbon dioxide, methane, chlorinated fluorocarbons (e.g. freon), nitrous oxide, and ozone.

A **ground electrode** is a long, buried, metal rod, connected to a DC-AC converter station.

Health is a state of complete physical, mental, spiritual and social well-being and not merely the absence of disease or infirmity.

Hydrometric information includes all data that are related to discharges, water levels and configurations of lakes and river channels.

Hydrology is the branch of physical geography that deals with the waters of the earth, their distribution, characteristics, and effects relative to human activities.

An **ice bridge** is a temporary crossing of a winter road over a stream channel.

The term **impacts**, in its generic sense, refers to the likely nature and extent of any consequences, positive or negative, of a proposed action.

Infrastructure:

1) the infrastructure of a project includes all of the physical structures of the project itself and all related physical structures associated with transportation and communication;
2) the infrastructure of a community includes the energy, transportation and communication facilities, and the political and social organizations within the community.

Landsat images are observations of the earth taken from satellites.

Load demand is the total demand of all electricity customers. It can be expressed in terms of power (MW) in which case the instantaneous peak demand of the year is quoted; or it can be expressed in terms of energy

(kW.h) in which case the total annual energy demand is quoted (1 GW.h= 10.6 kW.h).

Load forecasting is the practice of estimating the future demand for electricity.

As proposed, the **Manitoba-Ontario Interconnection** would consist of a 500 kV AC transmission line, and its related facilities, from the Winnipeg area to the Manitoba/Ontario border to connect the Manitoba and Ontario electrical power grids and enable Manitoba Hydro to export more electricity to Ontario.

Methyl mercury is an organic form of mercury, containing the methyl group (CH_3-). It has a high affinity for animal tissue and is concentrated upward in the food chain.

Mitigation is the process of eliminating, reducing or controlling any adverse environmental impacts of a project.

Monitoring includes any ongoing process or program for measuring the actual effects of constructing or operating a development.

Net interest is the nominal or current interest rate minus the rate of inflation.

The **Ontario sale** is the System Participation Agreement: Manitoba-Ontario Interconnection, between the Manitoba Hydro-Electric Board and Ontario Hydro, dated December 7, 1989.

The **opportunity cost** of using a resource in a particular way is the value that is thereby foregone by not deploying the resource in its best alternative use.

The **option value** is the value attached to the future availability of a resource by those who may or may not avail themselves of the opportunity to use the resource in the future.

The **owner's overhead** includes all administrative and managerial expenses of the owner associated with a project.

The **Panel** is the six-member independent environmental assessment review panel jointly appointed by the federal and Manitoba Ministers of the Environment.

A **participant** is a person or group presenting a position, views, concerns, questions or information to the Panel.

Peak demand is the highest power demand of the year, usually expressed in megawatts (MW). This usually occurs in mid-winter, during the late afternoon.

Plants are all aquatic and terrestrial plants including ice algae and phytoplankton.

Power is the rate at which electrical energy is produced per unit of time. It is usually expressed in kW or in MW.

Present value is the present equivalent sum of a payment or receipt that is expected to take place in the future. This is calculated by discounting the future amount to the present time.

The **Project** is the proposed Conawapa Project, which includes as its main components the Conawapa Generating Station, BiPole III Transmission Line Complex, and Manitoba-Ontario Interconnection.

The **Project Area** is the area of direct physical disturbance that would result from development of the Conawapa Project.

The **Proponent** is Manitoba Hydro.

The **real rate of return** is the rate of return with the inflation component removed. This is calculated by determining the discount rate that will equal the stream of uninflated income with the stream of uninflated costs during the life time of the Project.

Reserve capacity is that portion of the installed capacity that a utility wants to have in reserve, over and above the peak demand.

Residual Impacts are those effects which remain following the application of mitigative measures.

A **right-of-way** is a strip of land obtained and cleared for the purpose of building a road or a transmission line.

Sensitivity analysis is a means of testing the outcomes of various designs or strategies to obtain a better understanding of the financial risk.

A **severance line** is the height of land beyond which waters are not expected to rise on each Reserve that is a signatory to the Northern Flood Agreement.

Solar energy is derived from sunlight. This may be done via heating water or via the generation of electricity by means of photo-voltaic cells.

A **spillway** is a component of a dam that allows the escape of surplus water from the forebay upstream reservoir.

Storage capacity is the volume of water contained between the maximum and minimum allowable levels in a reservoir.

Streamflow entitlement refers to an agreement between the Provinces of Alberta, Saskatchewan and Manitoba that entitles Saskatchewan to 50% of the waters that originate in Alberta and that entitles Manitoba to 50% of the waters that Saskatchewan receives from Alberta plus 50% of the waters that originate in Saskatchewan.

The **Study Area** is defined in Section 1.3.3.

Surplus capacity is the amount of installed capacity over and above the peak demand plus reserve capacity.

Sustainable development is that development which meets the needs of the present, without compromising the ability of future generations to meet their own needs.

System losses are the losses in power and energy that take place between the source of generation and the consumer.

Technical potential refers to what is achievable through the best technology without regard to cost, in contrast to what is achievable when cost and other factors are considered.

A **thermal generating station,** sometimes referred to as a "stream plant", generates electricity by burning coal, oil or gas to convert water to steam, thereby driving a turbine that runs a generator.

Topographical maps show the elevations of the land by means of contour lines.

A **valued environmental component** is a special or highly regarded attribute or component of the environment identified on the basis of public or scientific concern.

Wind energy is derived from wind, usually by means of a propeller that drives a generator.

Appendix C

ETHICAL PRINCIPLES
FOR THE CONDUCT OF RESEARCH IN THE NORTH

Association of Canadian Universities for Northern Studies

Occasional Publication No.7

1982

(reprinted in part, with permission)

ASSOCIATION OF CANADIAN
UNIVERSITIES FOR NORTHERN STUDIES
ASSOCIATION UNIVERSITAIRE
CANADIENNE D'ÉTUDES NORDIQUES

ETHICAL PRINCIPLES FOR THE CONDUCT OF RESEARCH IN THE NORTH

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PRINCIPES D'ETHIQUE POUR LA CONDUITE DE LA RECHERCHE DANS LE NORD

Occasional Publication/Publication Occasionnelle
No. 7
1982

INTRODUCTION

In too many cases, researchers have worked in isolated communities without regard for the people who live there. Communities have been disrupted, and essential local resources used without consultation. Privacy is difficult in small communities, creating additional problems for participants. Guidelines, or principles, are needed so that research may be carried on with a minimum of friction and social disruption.

The principles proposed here are intended to promote cooperation and mutual respect between researchers and the people of the North.

Northerners are involved with research in several different ways:

1. As research subjects
2. Providing information
3. As part of a research team
4. Using the completed research
5. Identifying research needs.

If research is to be explained clearly, conducted ethically, and used constructively, it must be guided by principles that consider all of the above mentioned ways in which Northerners are likely to be involved in research activities.

PRINCIPLES

1. The research must respect the privacy and dignity of the people.

2. The research should take into account the knowledge and experience of the people.

3. The research should respect the language, traditions and standards of the community.

4. The person in charge of the research is accountable for all decisions on the project, including the decisions of subordinates.

5. No research should begin before being fully explained to those who might be affected.

6. No research should begin without the consent of those who might be affected.

7. In seeking informed consent, researchers should clearly identify sponsors, purposes of the research, sources of financial support, and investigators responsible for the research.

8. In seeking informed consent, researchers should explain the potential effects of the research on the community and the environment.

9. Informed consent should be obtained from each participant in research, as well as from the community at large.

10. Participants should be fully informed of any data gathering techniques to be used (tape and video recordings, photos, physiological measures, etc.), and the use to which they will be put.

11. No undue pressure should be applied to get consent for participation in a research project.

12. Research subjects should remain anonymous unless they have agreed to be identified; if anonymity cannot be guaranteed, the subject must be informed of the possible consequences of this before becoming involved in the research.

13. If, during the research, the community decides that the research may be unacceptable to the community, the researcher and the sponsor should suspend the study.

14. On-going explanations of research objectives, methods, findings and their interpretation should be made available to the community, with the opportunity for the people to comment before publication; summaries should also be made available in the local language.

15. Subject to requirements for anonymity, descriptions of the data should be left on file in the communities from which

it was gathered, along with descriptions of the methods used and the place of data storage.

16. All research reports should be sent to the communities involved.

17. All research publications should refer to informed consent and community participation.

18. Subject to requirements for anonymity, publications should give appropriate credit to everyone who contributes to the research.

DEFINITIONS

The principles refer to research in its broadest sense, including fundamental or applied research in the physical, biological, or social sciences. Surveys or monitoring studies would also be included. In general, "research" includes all technological activities in the North. Even mineral and petroleum exploration surveys would be expected to honour the general principles. However, the more detailed principles on informed consent and reporting of research results are meant specifically for researchers and might not apply to all technological acitivities.

The principles focus on those aspects of science that affect local people, communities and their environment. Even where research does not involve the local people in an obvious way, it may still have effects on the land, water or wildlife of the region, and may thus affect the people indirectly.

The word "community" is not restricted to the area of a settlement. The surrounding land that supplies resources for the settlement, and the people who live on the surrounding land, are viewed as part of the community.

The geographic area of concern includes Yukon Territory, the Northwest Territories, Nouveau-Québec, Labrador and the northern parts of the provinces from Ontario to British Columbia (the Extreme North, Far North, and Middle North as defined by Louis-Edmond Hamelin (1975)). Although the emphasis is on isolated northern communities, the general principles are not unique to the North and most of them could be applied elsewhere.

Appendix D

CONAWAPA PROJECT LOCATION MAPS

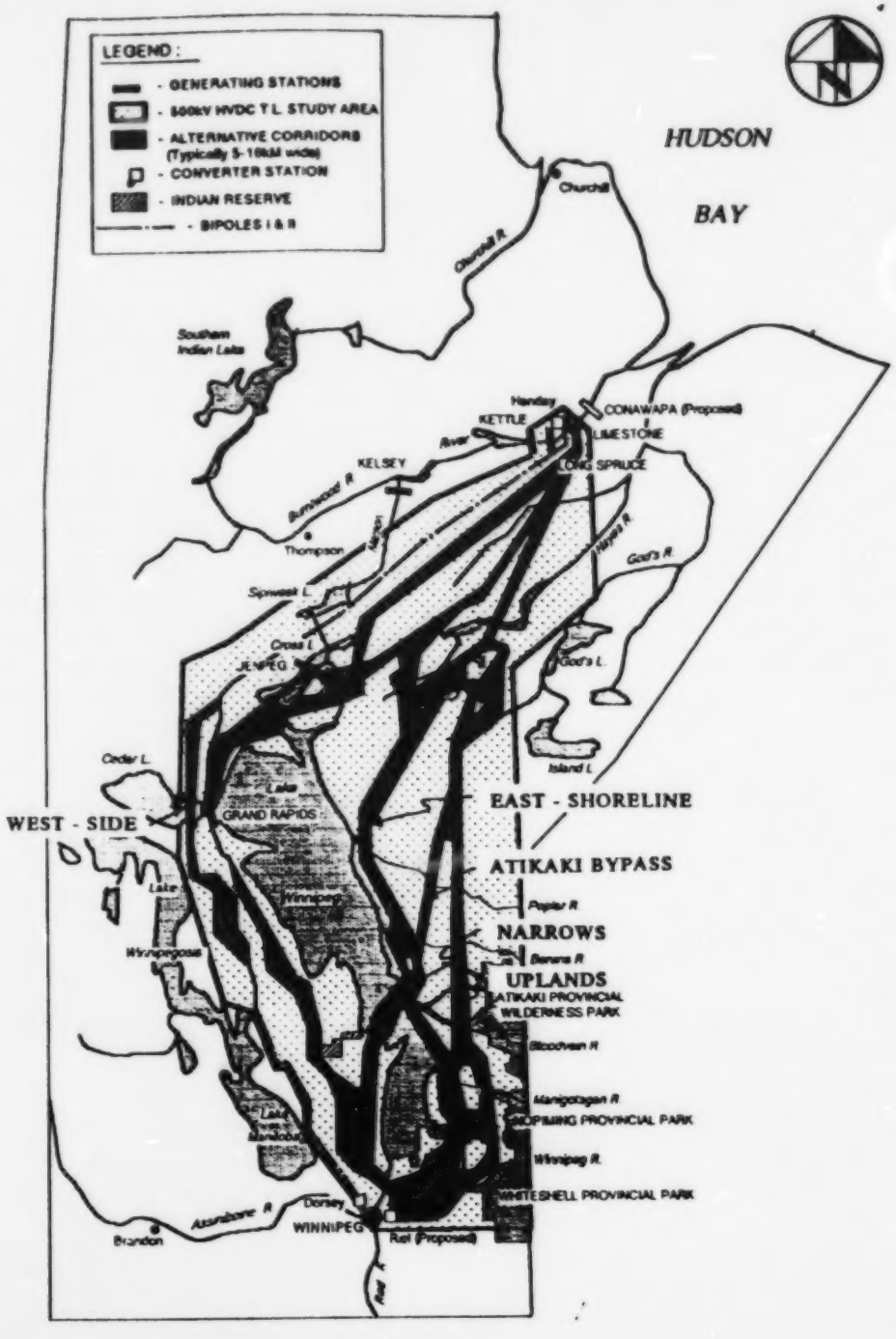

Figure D. 1. Location of the proposed Conawapa Generating Station, the alternative corridors for the proposed Bipole III transmission line, and the proposed Riel Converter Station (courtesy of Manitoba Hydro).

Figure D. 2. Northern and southern alternative routes for the proposed Dorsey-Riel Link between the existing Dorsey Converter Station, which would be upgraded, and the proposed Riel Converter Station (after Manitoba Hydro, 1992, pg. 4).

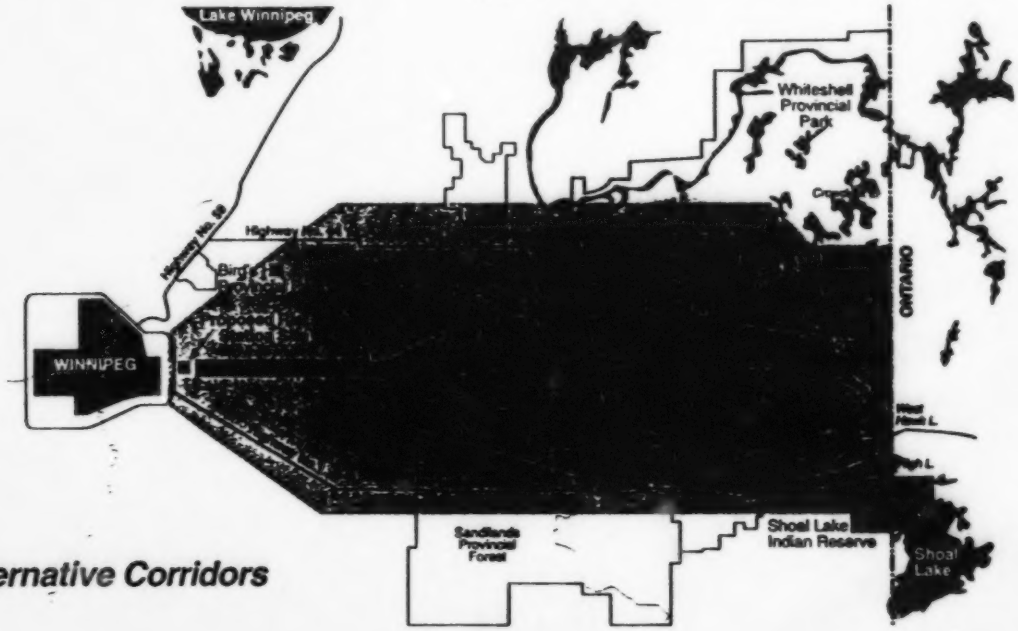

Figure D. 3. Alternative transmission line corridors for the proposed Manitoba-Ontario Interconnection from the proposed Riel Converter Station to the Ontario border (from Manitoba Hydro, 1991, pg. 11).